1 Conference after new year Bryder Davis

Postponed — 23-566

TRANSCRIPT OF RECORD

SUPREME COURT OF THE UNITED STATES.

No. ~~259.~~ 58

THE AMERICAN WOOD-PAPER COMPANY, APPELLANT,

vs.

THE FIBRE-DISINTEGRATING COMPANY.

FILED DECEMBER 8, 1871.

No. ~~362.~~ 157

THE FIBRE-DISINTEGRATING COMPANY, APPELLANT,

vs.

THE AMERICAN WOOD-PAPER COMPANY.

FILED MARCH 9, 1872.

APPEALS FROM THE CIRCUIT COURT OF THE UNITED STATES FOR THE EASTERN DISTRICT OF NEW YORK.

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SUPREME COURT OF THE UNITED STATES.

No. 259.

THE AMERICAN WOOD-PAPER COMPANY, APPELLANT,

vs.

THE FIBRE-DISINTEGRATING COMPANY.

No. 362.

THE FIBRE-DISINTEGRATING COMPANY, APPELLANT,

vs.

THE AMERICAN WOOD-PAPER COMPANY.

APPEALS FROM THE CIRCUIT COURT OF THE UNITED STATES FOR THE EASTERN DISTRICT OF NEW YORK.

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a UNITED STATES OF AMERICA,
Eastern District of New York:

At a circuit court of the United States for the second circuit, begun and holden at the city of Brooklyn, within and for the eastern district of New York, on the 17th day of March, in the year of our Lord one thousand eight hundred and sixty-six.

Before the Honorable Charles L. Benedict, district judge.

THE AMERICAN WOOD-PAPER COMPANY
vs.
THE FIBRE-DISINTEGRATING COMPANY. } In equity.

The bill of complaint in this cause was filed in the clerk's office on the 17th day of March, A. D. 1866, when and where the complainants appeared by their solicitor, Francis C. Nye, and is in the words and figures following, namely:

1 In the circuit court of the United States for the eastern district of New York.

THE AMERICAN WOOD-PAPER COMPANY
vs.
THE FIBRE-DISINTEGRATING COMPANY. } In equity

To the judges of the circuit court of the United States for the eastern district of New York:

The American Wood-Paper Company, a corporation created by the legislature of the State of Rhode Island, & located & transacting business in said State, a citizen of said State, bring this their bill of complaint against The Fibre-Disintegrating Company, a corporation organized under the general statu'es of the State of New York, & located & transacting business at South Brooklyn, in the county of Kings, in said State, and in the eastern district of New York aforesaid, a citizen of said State of New York.

2 And thereupon your orators complain and say, on information and belief, that, heretofore, and before the 19th day of August, A. D. 1853, one Charles Watt and one Hugh Burgess, of London, England, were the original and first inventors or discoverers of a new and useful improvement in the manufacture of paper from wood; that, being such inventors, the said Watt and Burgess duly made application in writing to the Commissioner of Patents of the United States, for the granting of letters-patent for said improvement, and duly swore to the specification for that purpose; that the said improvement was not, at the time of said application, in public use, or on sale, with the consent or allowance of the said Watt and Burgess, as the inventors or discoverers thereof, contrary to the provisions of the statutes of the United States in such case made and provided, and was not known or used by others anterior to the invention or discovery thereof by the said Watt and Burgess; that the said Watt and Burgess duly complied, in all respects, with all the necessary conditions and requisitions of the statutes of the United States in such case made and provided, prior to the granting of the letters-patent hereinafter mentioned; that, on the 18th day of July, 1854, letters-patent of the United States, bearing date on said last-named day were issued to the said Watt and Burgess according to law, whereby there was granted to them, their heirs, administrators, or assigns, for

the term of fourteen years from the 19th day of August, 1853, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said improvement, a description whereof was given in the words of the said Watt and Burgess, in a schedule which was annexed to the said letters-patent, and was made a part of the same; that the said letters-patent were issued in the name of the United States of America, and were sealed with the seal of the Patent-Office of the United States, and were signed by the Secretary of the Interior of the United States, and were countersigned by the Commissioner of Patents, and were issued and delivered to the said Watt and Burgess.

And that before the said letters-patent were issued to them as
3 aforesaid, the said Watt and Burgess duly made affirmation before a person authorized by law to administer oaths, that they did verily believe that they were the original and first inventors or discoverers of the said improvement; that the same had not, to the best of their knowledge and belief, been previously known or used; and that they were subjects of the Queen of Great Britain; and the said Watt and Burgess also paid into the Treasury of the United States the sum of five hundred dollars.

And your orators, in like manner, further aver, that, afterwards, the said Charles Watt and the said Hugh Burgess, for valuable considerations paid them by one Frederic B. Houghton, did, by a certain instrument in writing by them signed and sealed, bearing date the 22d day of November, A. D. 1854, assign, sell, convey, and set over to the said Frederic B. Houghton, the right, title, and interest of the said Watt and Burgess in said letters-patent, and the invention thereby secured, for, to, and in the United States of America, for and during the full term for which said letters-patent were granted, which said assignment was duly recorded in the Patent-Office of the United States, on the day of A. D. as by said assignment, or a duly authenticated copy thereof, will fully and at large appear.

And your orators, in like manner, further aver that the said Frederic B. Houghton did, for a valuable consideration paid him by one William F. Ladd and one Morris L. Keen, by a certain instrument in writing, by him signed and sealed, bearing date the 20th day of March, A. D. 1855, assign, sell, convey, and set over to the said William F. Ladd and the said Morris L. Keen, the right, title, and interest of the said Houghton in said letters-patent, and the invention thereby secured, for, to, and in the United States of America, for and during the full term for which said letters-patent were granted; which said assignment was duly recorded in the Patent-Office of the United States, on the day of A. D. , as by said assignment, or a duly authenticated copy thereof will fully and at large appear.

And your orators, in like manner, further aver that, after the said 19th day of August, 1853, the said William F. Ladd and Morris L.
4 Keen did, on account of a defective specification, duly, and in accordance with the statute in such case made and provided, surrender the said patent for the purpose of having the said defective specification corrected, and of having, upon an amended specification, letters-patent issued therefor; and that the said Ladd and Keen also paid on said surrender the further duty of fifteen dollars, as by law required; and thereupon, and on the fifth day of October, A. D. 1858, a new patent, bearing date the day and year last aforesaid, was duly issued to the said William F. Ladd and Morris L. Keen, their heirs, administrators, or assigns, on a corrected specification by the said Ladd and Keen, duly made

and duly filed, for an improvement in the manufacture of paper from wood for the residue of the unexpired term of said original letters-patent, that is to say, for the term of fourteen years from the aforesaid 19th day of August, A. D. 1853.

And your orators, in like manner, further aver that, after the said fifth day of October, A. D. 1858, the said Ladd and Keen did, on account of a defective specification, duly, and in accordance with the statute in such case made and provided, surrender the last aforesaid re-issued patent for the purpose of having the said defective specification corrected, and the inventions or discoveries therein described separated, and two separate letters-patent issued therefor, and that the said Ladd and Keen also paid on such surrender the further duty of thirty dollars, as by law required; and thereupon, and on the seventh day of April, A. D. 1863, two new patents, bearing date the day and year last aforesaid, were duly issued to the said Ladd and Keen, their heirs, administrators, or assigns, on two corrected specifications by the said Ladd and Keen, duly made and duly filed, one for the improved process of treating wood and other vegetable substances in the manufacture of paper from pulp, and the other for an improved pulp from wood or other vegetable substances for the manufacture of paper, each of which said last-named letters-patent was issued for the residue of the then unexpired term of said original letters-patent, that is to say, for the term of fourteen years from the said 19th day of August, A. D. 1853.

And your orators further aver that copies of said letters-patent, so as aforesaid re-issued to said Ladd and Keen, and of the schedules thereto annexed, are hereto annexed marked, respectively, A and B, and your orators pray that the same may be taken as part of this bill. And your orators aver that the last-aforesaid letters-patent, so re-issued, together with the said corrected specifications, have the same effect and operation in law as though the same had been originally filed in such corrected form before the issuing of the said original patent, and that said letters-patent, so re-issued as aforesaid, have the same effect in law as though they had been originally issued for the term of fourteen years from the said 19th day of August, A. D. 1853.

And your orators further aver, of their own knowledge, that, afterwards, the said Ladd and Keen, for valuable considerations paid them by Benjamin Buffum, trustee to the American Wood-Paper Company, did, by a certain instrument in writing, by them signed and sealed, bearing date the 18th day of May, A. D. 1863, bargain, sell, assign, transfer, and convey unto the said Benjamin Buffum, trustee as aforesaid, and to the said American Wood-Paper Company, their successors and assigns, all the right, title, and interest of the said Ladd and Keen in said original letters-patent and the letters-patent re-issued in the patent April 7th, 1863, as aforesaid, and the invention therein described, for, to, and in the United States of America, for and during the full term for which said letters-patent and the said re-issues thereof, are or may be granted, which said assignment was duly recorded in the Patent-Office of the United States, on the 23d day of October, A. D. 1863, in liber D 7, page 113, of transfers of patents, as by said assignment, or a duly authenticated copy thereof, and the certificate of the recording thereof, ready in court to be produced, a copy of which is hereto annexed, marked C, will fully and at large appear.

And your orators further aver that the said Benjamin Buffum, by instrument in writing, duly executed, and recorded in the Patent-Office, did, on the 16th day of June, A. D. 1865, assign and convey to your orators all his interest in the said letters-patent and the invention therein

named, a copy of which instrument is hereto annexed and made a part of this bill, marked D.

6 And your orators aver that, by virtue of the hereinbefore-recited premises, your orators became and are possessed of and vested with the sole aforesaid exclusive right, during the period aforesaid, to use the invention of the said Watt and Burgess, as described and set forth in the last-aforesaid two re-issued patents, within the whole of the United States, and have, from the day of the date of the said last-mentioned assignment to said Benjamin Buffum, trustee to the American Wood-Paper Company, continued to be and now are the sole and exclusive owners of said sole and exclusive right to said invention and thing patented, within the whole of the United States.

And your orators further complain and say, upon information and belief, that, heretofore, and before the seventh day of August, A. D. 1854, one Marie Amédeé Charles Mellier, of Paris, France, was the original and first inventor or discoverer of a new and useful improvement in making paper-pulp; that, being such inventor, the said Mellier duly made application in writing to the Commissioner of Patents of the United States for the granting of letters-patent for said improvement, and duly swore to the specification for that purpose; that the said improvement was not at the time of said application in public use or on sale with the consent or allowance of the said Mellier as the inventor or discoverer thereof, contrary to the provisions of the statutes of the United States in such case made and provided, and was not known or used by others anterior to the invention or discovery thereof by the said Mellier; that the said Mellier duly complied in all respects with all the necessary conditions and requisitions of the statutes of the United States in such case made and provided, prior to the granting of the letters-patent hereinafter mentioned; that, on the twenty-sixth day of May, A. D. 1857, letters-patent of the United States, bearing date on said last-named day, were issued to the said Marie Amédeé Charles Mellier, according to law, whereby there was granted to him, his heirs, administrators, or assigns, for the term of fourteen years, from the seventh day of August, A. D. 1854, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said improvement, a description whereof was given in the words of the said Mellier, in a schedule which was annexed to the said letters-pat-

7 ent, and was made a part of the same; that the said letters-patent were issued in the name of the United States of America, and were sealed with the seal of the Patent-Office of the United States, and were signed by the Secretary of the Interior of the United States, and were countersigned by the Commissioner of Patents, and were issued and delivered to the said Mellier.

And that, before the said letters-patent were issued to him as aforesaid, the said Mellier duly made oath before a person authorized by law to administer oaths, that he did verily believe that he was the original and first inventor or discoverer of the said improvement; that the same had not, to the best of his knowledge and belief, been previously known or used, and that he was a citizen of France; and the said Mellier also paid into the Treasury of the United States the sum of three hundred dollars.

And your orators further aver that a copy of said letters-patent, so as aforesaid issued to said Mellier, and of the schedule thereto annexed, are hereto annexed, marked "E," and your orators pray that the same may be taken as part of this bill.

And your orators further aver, upon like knowledge, that, afterwards,

the said Mellier, by his attorney, Victor Beaumont, thereunto duly authorized and empowered, by an instrument in writing, by the said Mellier duly executed, ready in court to be produced, a copy of which is hereto annexed, marked F, for good and valuable considerations paid him by one Coe S. Buchanan, of the city, county, and State of New York, did, by a certain instrument in writing by the said Mellier, by his attorney, the said Victor Beaumont, duly signed and sealed, and bearing date the 19th day of June, A. D. 1857, sell, assign, and set over unto the said Coe S. Buchanan, all his right, title, and interest in the said invention, as secured to him by the said patent, for, to, and in the United States of America and its Territories, the same to be held and enjoyed by the said Coe S. Buchanan, for his own use and behoof, and for the use and behoof of his legal representatives, to the full end of the term for which said letters-patent were or might be granted, which said assignment was
8 duly recorded in the Patent-Office of the United States, in book M 4, page 98, of transfers of patents, on the 25th day of June, 1857, as by said assignment, or a duly authenticated copy thereof, and the certificate of recording thereof, ready in court to be produced, a copy of which is hereto annexed, marked "G," will fully and at large appear.

And your orators further aver, upon information and belief, that, about the day of , A. D. 18 , the said Coe S. Buchanan, being then the owner of the title to the Mellier patent, and of the invention therein described, instituted a suit in equity in the circuit court of the United States for the northern district of New York, against one Gardner Howland and one Joseph B. Palser, and in the bill filed in said cause set out the said Mellier patent as aforesaid, and his title thereto, and to the invention therein described for an improvement in the manufacture of paper, and alleging an infringement thereof by the said Howland and Palser, and praying an injunction and account against the said Howland and Palser. To which bill of complaint the said Howland and Palser filed their answer, denying the validity of the said letters-patent, and setting up that some other persons than said Mellier were the inventors of the things patented to him by said letters-patent; and that said Mellier, and said Buchanan, as his assignee, had no title by reason thereof in and to his said alleged invention, and also denied the allegation of the infringement of said letters-patent; and issue being joined thereon, and the proofs in said cause being taken at great length, the cause was brought to final hearing on its merits, and was argued by counsel at the term of the circuit court of the United States for the northern district of New York, in the year , before Mr. Justice Nelson and Judge Hall; and was, by them, held under advisement until the term of said court then next following, when the judgment of the court was pronounced and an opinion delivered by his honor Judge Hall, which was concurred in by Mr. Justice Nelson:

That the said court then and there decided that the said letters-patent were valid in law, and that the said Mellier was the first and original inventor of the improvements described in his said specification:
9 And that the said defendants Howland and Palser infringed upon said letters-patent by the wrongful use of said invention.

And that a decree to that effect was thereupon entered by said court, as by reference to the records of said court, and particularly to said opinion and decree, a copy of which is hereto annexed, marked "H," will more fully appear.

And your orators further aver, of their own knowledge, that, after-

wards, the said Coe S. Buchanan, for valuable considerations paid him by Benjamin Buffum, trustee to the American Wood-Paper Company, did, by a certain instrument in writing, by him signed and sealed, bearing date the 14th day of October, A. D. 1863, bargain, sell, assign, transfer, and convey unto the said Benjamin Buffum, trustee as aforesaid, and to the said American Wood-Paper Company, their successors and assigns, all the right, title, and interest of the said Buchanan in said letters-patent, and in and to the invention therein described, being the entire title therein and thereto, for and during the period from the date of said letters-patent till the expiration of the term for which said letters-patent were originally granted, and for such other terms or periods as said letters-patent may be renewed or extended; which said assignment was duly recorded in the Patent-Office of the United States, on the 23d day of October, A. D. 1863, in liber D 7, page 118, of transfers of patents, as by said assignment, or a duly authenticated copy thereof, and the certificate of recording thereof, ready in court to be produced, a copy of which is hereto annexed, marked "I," will fully and at large appear.

And your orators aver that, by virtue of the hereinbefore-recited premises, your orators became and were possessed of, and vested with, the sole aforesaid exclusive right, during the period aforesaid, to use the invention of the said Charles Mellier, as described and set forth in the last aforesaid patent, within the whole of the United States, and have, from the day of the date of the said last-mentioned assignment to said Benjamin Buffum, trustee to the American Wood-Paper Company, continued to be, and now are, the sole and exclusive owners of said sole and exclusive right to said invention and thing patented, within the whole of the United States.

10 And they further aver that the said Benjamin Buffum, by his instrument of assignment, bearing date the 16th day of June, 1865, a copy of which is hereto annexed, marked K, confirmed to your orators their title as aforesaid.

And your orators further aver that, since said 14th day of October, A. D. 1863, they became, so as aforesaid, vested with said sole and exclusive rights to the said patents above named, and that they have continued to enjoy the same, and each thereof, in the manufacture of paper from wood, and in the manufacture of paper-pulp from wood and other vegetable substances, except as said rights have been infringed upon by the defendants and others, and have derived great profit from the use of said rights.

11 And your orators further aver, that, heretofore, and before the 13th day of September, A. D. 1859, one Morris L. Keen, of Royer's Ford, Pennsylvania, a citizen of the United States, was the original and first inventor of a new and useful improvement in boilers for making paper-pulp from wood; that, being such inventor, the said Keen duly made application, in writing, to the Commissioner of Patents of the United States for the granting of letters-patent for said improvement, and duly swore to the specification for that purpose; that the said improvement was not, at the time of the said application, in public use or on sale with the consent and allowance of the said Keen, of the inventor or discoverer thereof, contrary to the provisions of the statutes of the United States in such case made and provided, and was not known or used by others anterior to the invention and discovery thereof by the said Keen; that the said Keen duly complied, in all respects, with all the necessary conditions and requisitions of the statutes of the United States in such case made and provided, prior to

the granting of the letters-patent hereinafter mentioned; that, on the 13th day of September, A. D. 1859, letters-patent of the United States, bearing date on said last-named day, were issued to the said Keen according to law, whereby there was granted to him, his heirs, administrators, or assigns, for the term of fourteen years from the said 13th day of September, 1859, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said improvement, a description whereof was given in the words of the said Keen, in a schedule which was annexed to the said letters patent, and was made a part of the same; that the said letters-patent were issued in the name of the United States of America, and were sealed with the seal of the Patent-Office of the United States, and were signed by the Secretary of the Interior of the United States, and were countersigned by the Acting Commissioner of Patents, and were issued and delivered to the said Keen; and that before the said letters-patent were issued to him as aforesaid, the said Keen duly made oath before a person authorized by law to administer oaths, that he did verily believe that he was the original and first inventor or discoverer of the said im-
12 provement; that he did not know or believe that the same was ever before known or used, and that he was a citizen of the United States; and the said Keen also paid into the Treasury of the United States the sum of thirty dollars.

And your orators further aver that a copy of said letters-patent, so as aforesaid issued to said Keen, and of the schedule thereto annexed, is hereto annexed, marked L; and your orators pray that the same may be taken as part of this bill.

And your orators, in like manner, further aver that, afterwards, the said Morris L. Keen, for a valuable consideration paid him by Benjamin Buffum, trustee for the American Wood-Paper Company, did, by a certain instrument in writing, by him signed and sealed, bearing date the 18th day of May, A. D. 1863, grant, bargain, and sell to said Buffum, trustee, and to said American Wood-Paper Company, an absolute and exclusive license to use said invention within and throughout the United States of America, for the full term for which said letters-patent were granted, and during any extension or renewal thereof; which said assignment was duly recorded in the Patent-Office of the United States on the 23d day of October, 1863, in liber D 7, page 111, of the transfers of patents, as by said assignment or a duly authenticated copy thereof, and the certificate of the recording thereof, ready in court to be produced, a copy of which is hereto annexed, marked M, will fully and at large appear.

And your orators aver, that by virtue of the hereinbefore-recited premises, your orators became and are possessed of, and vested with, the sole aforesaid exclusive right, during the period aforesaid, to make, construct, use, sell, and vend to others the right to make and use the said invention of said Keen, as described and set forth in said patent, within the whole of the United States, and had, from the day of the date of said last-mentioned assignment to them hitherto, continued to be, and now are, the sole and exclusive owners of said sole and exclusive right to said invention and thing patented, within the whole of the United States, and are entitled to be protected in the enjoyment of the same.

13 And your orators further aver that, heretofore, and before the 16th day of June, A. D. 1863, the said Morris L. Keen, of Royer's Ford, Pennsylvania, a citizen of the United States, was the inventor of a new and useful improved boiler for making paper-pulp; that, being

such inventor, the said Keen duly made application in writing to the Commissioner of Patents of the United States for the granting of letters-patent for said improvement, and duly swore to the specification for that purpose; that the said improvement was not, at the time of the said application, in public use or on sale with the consent and allowance of the said Keen as the inventor or discoverer thereof, contrary to the provisions of the statutes of the United States in such case made and provided, and was not known or used by others anterior to the invention or discovery thereof by the said Keen; that the said Keen duly complied, in all respects, with all the necessary conditions and requisitions of the statutes of the United States in such case made and provided, prior to the granting of the letters-patent hereinafter mentioned; that, on the 16th day of June, A. D. 1863, letters-patent of the United States, bearing date on said last-named day, were issued to the said Keen according to law, whereby there was granted to him, his heirs, administrators, or assigns, for the term of fourteen years from the said 16th day of June, 1863, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said invention, a description whereof was given in the words of the said Keen in a schedule which was annexed to the said letters-patent, and was made a part of the same; that the said letters-patent were issued in the name of the United States of America, and were sealed with the seal of the Patent-Office of the United States, and were signed by the Acting Secretary of the Interior of the United States, and were countersigned by the Commissioner of Patents, and were issued and delivered to the said Keen.

And that, before the said letters-patent were issued to him as aforesaid, the said Keen duly made oath, before a person authorized by law to administer oaths, that he did verily believe that he was the original and first inventor or discoverer of the said improvement; that he did not know or believe that the same was ever before known or used; and that he was a citizen of the United States; and the said Keen
14 also paid into the Treasury of the United States the sum of thirty-five dollars.

And your orators further aver that a copy of said letters-patent, so as aforesaid issued to said Keen, and of the schedule thereto annexed, is hereto annexed, marked N, and your orators pray that the same may be taken as a part of this bill.

And your orators further aver that the said patent of June 16th, 1863, was for an improvement on the invention described and included in the patent of Sept. 13th, 1859; and that the above-described license of May 18th, 1863, covered said patent of June 16th, 1863, and gave your orators the right to use said invention as fully and completely as it did the right to use said invention, patented Sept. 13th, 1859.

And your orators further aver that the said Benjamin Buffum, by his instrument of assignment, bearing date the 16th day of June, 1865, a copy of which is hereto annexed, marked O, confirmed to your orators their title as aforesaid.

And your orators, in like manner, further aver that, afterwards, the said Morris L. Keen, for a valuable consideration paid him by the American Wood-Paper Company, did, by a certain instrument in writing, or agreement, entered into by and between him and said company, and by them signed and sealed, bearing date the eleventh day of July, A. D. 1865, assign and convey unto the said American Wood-Paper Company, all his right, title, and interest, in and to said letters-patent of Sept. 13th, 1859, *or* by said assignment, a copy of which is hereto annexed, marked P, will fully and at large appear.

15 And your orators further show, upon information and belief, that, ever since the 18th day of April, A. D. 1863, the defendants well knowing the premises, and the rights and privileges secured to your orators by the said several letters-patent aforesaid, acquired by the transfers hereinbefore averred and set forth, did contrive to injure your orators, and to defraud them of their profits, benefits and advantages which might and otherwise would have accrued to them, at said Brooklyn, and within the eastern district of New York, and without the license and permission of your orators, since the 18th day of April, have unlawfully and wrongfully manufactured and sold large quantities of paper and paper-pulp, manufactured in accordance with the descriptions set forth, and by means of the processes and machinery described in the specifications annexed to said letters-patent, or some one or more of them, and have manufactured and sold or used or vended to others to be used, large quantities of the new manufacture, called paper-pulp, manufactured by chemical process, as described in the specifications of the said re-issued No. 1448 of the Watt and Burgess patent, and are now unlawfully and wrongfully manufacturing and using or vending to others to be used, large quantities of paper and paper-pulp, manufactured in accordance with the descriptions set forth, and by means of the processes and machinery described in the specifications annexed to said letters-patent, or some one or more of them, and are now manufacturing and selling, or using and vending to others to be used, large quantities of the new manufacture, called paper-pulp, manufactured by chemical process as described in the specification of the said re-issue, No. 1448 of the Watt and Burgess patent, and that said paper and paper-pulp so manufactured and sold or used by said defendants, is manufactured by the use of the machinery and processes described in the foregoing patents, used in combination with each other, or in a combination of some two or more of them. But what quantity of paper and paper-pulp,

16 manufactured according to said processes or some one of them, has been manufactured or sold or caused to be sold by said defendants, or what quantity of said new manufacture of paper-pulp has been manufactured or used or sold to others to be used by said defendant, your orators do not know and cannot state; but, upon information and belief, your orators aver that they have sold to others to be used, and have manufactured and used large quantities of the same, and are now selling to others to be used, and manufacturing and using large quantities of the same; and that they have derived and received, and still deriving and receiving from such sale, great gains and profits, but to what amount your orators are ignorant, and cannot set forth; but your orators believe the same to be of the full sum of two hundred thousand dollars, and so charge the fact to be; and pray that the defendant may be required to make a disclosure of all such gains and profits.

And your orators, in like manner, aver that the defendants continued to manufacture and sell said paper and paper-pulp, and said new manufacture of paper-pulp, and the use thereof, as aforesaid, though warned and requested to desist from said manufacture, sale and use, or to pay to your orators the said gains and profits, by means whereof the defendants have greatly injured, and *have* still greatly injuring your orators, and have deprived and *have* still depriving your orators from receiving the gains and profits from the exclusive right to use the inventions and improvements claimed in the said re-issued letters-patent, and other letters-patent as aforesaid, which your orators otherwise, and but for said wrongful acts of the defendants, would have obtained and received.

And your orators pray that the said defendant' may be compelled, by

a decree of this court, to account for and to pay over to your orators all such gains and profits as have accrued or arisen to, or been earned or received by, said defendant, and all such gains and profits as have been received, or to which they may be entitled by reason of such sale by them of paper-pulp manufactured from wood and other vegetable substances, and of paper manufactured from wood, in accordance with the specifications of the above-named letters-patent and in infringement thereof, and all such gains and profits as your orators would have
17 received but for the unlawful acts and doings of the said defendants; and that the said defendants, their attorneys, solicitors, servants, agents, and workmen, may be perpetually enjoined and restrained by the decree and injunction of this court, from directly or indirectly making or causing to be made, or using or causing to be used, or vending to others to be used in any manner, any paper-pulp manufactured from wood or other vegetable substances, or any paper manufactured from wood, substantially as described in any or all of the above-named patents, namely, the two re-issued patents re-issued to Ladd & Keen, April 7th, 1863, and the patent issued to Marie Amédeé Charles Mellier, May 26th, 1857; and from using any of the inventions or improvements described and claimed in said re-issued patents re-issued to Ladd and Keen, and in said patent issued to said Mellier, in the manufacture of paper-pulp from wood or other vegetable substances, and in the manufacture of paper from wood; and from infringing upon or violating the said re-issued letters-patent re-issued to the said Ladd and Keen, and the patent issued to the said Mellier, in respect of the exclusive rights vested in your orators.

18 And that all such infringing paper, or paper-pulp, may be forthwith destroyed or delivered up to your orators; and that the defendants may be decreed to pay the costs of this suit; and that your orators may have such other relief as the equity of the case may require, and as to your honors may seem meet.

To the end, therefore, that the said defendant' may, if they can, show why your orators should not have the relief hereby prayed, and may full, true, and direct answer make, according to the best of their knowledge, remembrance, information, and belief, to the several matters hereinbefore averred and set forth, as fully and particularly as if the same were here repeated, paragraph by paragragh, and they specially interrogated thereunto severally, may it please your honors to give unto your orators a writ of subpœna ad respondendum, issuing out of and under the seal of this honorable court, directed to the said defendants, commanding them to appear and make answer to this bill of complaint, and to perform and abide by such order and decree herein as to this court may seem required by the principles of equity and good conscience.

May it also please your honors, to grant unto your orators a provisional or preliminary injunction, issuing out of and under the seal of this honorable court, enjoining and restraining the defendants, their attorneys, solicitors, servants, workmen, and agents, to the same purport, tenor, and effect hereinbefore prayed for in regard to said perpetual injunction.

And your orators will ever pray.

AMERICAN WOOD-PAPER CO.
By B. BUFFUM, *Treas.*

FRANCIS C. NYE,
Solicitor for Complainants.
Solicitors for Complainants.

T. A. JENCKES,
Of Counsel.

19 DISTRICT OF RHODE ISLAND, *sc:*

I, Benjamin Buffum, treasurer of the said American Wood-Paper Company, do solemnly affirm that the facts and statements in said bill contained, which are made upon knowledge, are true, to the knowledge of this affiant, and that those which are made upon information and belief are true, according to the best of his information and belief, and according to the best of the information and belief of said complainants.

BENJAMIN BUFFUM.

Subscribed and affirmed to before me this 14th day of October, A. D. 1865.

SAM'L W. PECKHAM,
Commissioner appointed by the Circuit Court of the United States for said R. I. District to take affadavits, bail, &c.

[U. S. int. rev. 5-ct. stamp.]

20

21 EXHIBIT "A."—RE-ISSUE No. 1448.

The United States of America to all to whom these letters-patent shall come:

Whereas William F. Ladd, of New York, New York, and Morris L. Keen, of Philadelphia, Pennsylvania, assignees (through mesne assignments) of Charles Watt and Hugh Burgess, of London, England, have alleged that said Charles Watt and Hugh Burgess invented a new and useful improved pulp from wood, &c., for the manufacture of paper, (for which letters-patent were issued to them, dated July 18, 1854, and antedated August 19, 1853, the same surrendered by said assignees, and new letters issued to them on an amended specification, dated October 5, 1858, which last letters having been surrendered by them, the same have been canceled, and new letters ordered to issue to them, on two separate amended specifications,) which they stated had not been known or used before their application; had made oath that they were subjects of the Queen of Great Britain; that they did verily believe that they were the original and first inventors or discoverers of the said invention, and that the same hath not, to the best of their knowledge and belief, been previously known or used; said Ladd and Keen having paid into the Treasury of the United States the sum of thirty dollars, and presented a petition to the Commissioner of Patents signifying a desire of obtaining an exclusive property in the said invention, and praying that a patent may be granted for that purpose:

These are, therefore, to grant, according to law, to the said William F. Ladd and Morris L. Keen, their heirs, administrators, or assigns, for the term of fourteen years from the nineteenth day of August, one thousand eight hundred and fifty-three, the full and exclusive right
22 and liberty of making, constructing, using, and vending to others to be used, the said invention, a description whereof is given in the words of the said Ladd & Keen, in the schedule hereunto annexed, and is made a part of these presents.

In testimony whereof I have caused these letters to be made patent, and the seal of the Patent-Office has been hereunto affixed.

Given under my hand, at the city of Washington, this seventh day of April, in the year of our Lord one thousand eight hundred and sixty-

three, and of the Independence of the United States of America the eighty-seventh.

(Signed) J. P. USHER,
Sec'y of the Interior.

Countersigned and sealed with the seal of the Patent-Office.

(Signed) D. P. HOLLOWAY,
Commissioner of Patents.

The schedule referred to in these letters-patent and making part of the same.

To all whom it may concern:

Be it known that Charles Watt and Hugh Burgess, of London, England, did invent a new and useful improvement in the manufacture of paper-pulp from wood and other vegetable substance, and that the following is a full, clear, and exact description thereof:

The wood or vegetable substance from which it is intended to make the pulp should be first reduced to fine shavings or cuttings. This may be done in any suitable machine.

The shavings or cuttings of wood, or the vegetable substances, are then to be boiled in a solution of caustic alkali, in a suitable boiler, under pressure. The strength of the alkali is dependent on the nature of the vegetable substance used and operated upon. For non-resinous woods, a solution of alkali, of the strength indicated by 17° of the English hydrometer, or thereabouts, answers very well, and for deal, pine, or fir-wood, or other woods containing resinous matter, a strength of about 12° is sufficient, but varying with the nature of the vegetable substance being acted upon, to a strength of about 10 degrees. The varied nature of the vegetable substance to be operated upon is such that only general directions can be given for the strength of the alkali or the degree of heat to be used, or the duration of the operation. Boiling in a solution of caustic alkali, under pressure, is of essential importance.

By the words "under pressure," is meant a pressure at, near, or above 300 degrees of Fahrenheit's scale, which is the ordinary pressure used; but a heat and corresponding pressure of from 300 to 500 degrees may be used, according to the nature of the vegetable substance to be treated, whether resinous or non-resinous, or otherwise, and the time may be from four to twelve hours, according to the nature of the substance.

After the vegetable substance has been thus operated upon by caustic alkali, under heat and pressure for the requisite time, as above described, it should be discharged from the boiler, while under pressure, into a tank or other reservoir, with proper safety-valves and pipes for the discharge of the steam, and should be drawn, as soon as the steam shall have escaped, into open vats, where it can be operated upon in the next stage of the process, or it may be drawn directly into the vats from the boiler.

The vats which receive the wood shavings or cuttings, or other vegetable substances being formed into pulp, should be constructed with suitable means of drainage. The alkaline solutions must then be removed from the pulp, either by percolation and subsequent washing in the vats, or by pressure in any convenient apparatus and subsequent washing. The mode of percolation has generally been found sufficient.

The alkaline solutions thus obtained may be saved and evaporated down, and the residuum burned in a furnace suitably constructed, so as to prepare the alkaline substances for use in a repetition of the same

process. The alkaline solutions having been removed by percolation and washing, or by pressure and washing, the wet mass of woody or vegetable pulp is now to be exposed to the action of chlorine, or the compounds of chlorine with oxygen, for the purpose of bleaching
24 it and preparing it for the manufacture of white paper. Brown, colored, or unbleached paper of a good quality, can be produced from the pulp as soon as the alkaline solutions are removed; but for the production of good white paper it is necessary to subject the pulp to the bleaching process. If the material used be wood or vegetable substance of a non-resinous nature, the pulp may be bleached by subjecting it to the action of chlorine in a gaseous form, or, which is preferable in this case, in an aqueous solution, in any of the common and well-known modes.

If the wood or vegetable substance be of a resinous nature, the alkaline solutions should be removed by the mode above described, and the pulpy mass should be exposed to the action of chlorine, or its compounds with oxygen. This may be done by placing the pulpy mass of woody or vegetable substance on racks or drawers arranged in a chamber, and applying chlorine, or its compounds with oxygen, in the gaseous form, which, with resinous substances, is preferable to the aqueous solution, until the mass is sufficiently acted upon. The mass must then be again well washed and treated with a weak solution of caustic alkali, warm preferred, which changes the red color to a dark brown. The alkaline solution should then be removed by washing, and the resulting gray pulp may be bleached by any ordinary method of bleaching.

What we claim in this patent, as the invention of Charles Watt and Hugh Burgess, as a new article of manufacture, is a pulp suitable for the manufacture of paper, made from wood or other vegetable substances, by boiling the wood or other vegetable substance in an alkali under pressure, substantially as described.

(Signed) WILLIAM F. LADD.

Witnesses to W. F Ladd—
JONATHAN S. ODELL.
SAM'L COLES.

(Signed) MORRIS L. KEEN.

Witnesses to M. L. Keen—
GEO. C. WARD.
PATRICK WARD.

25 EXHIBIT "B."—RE-ISSUE No. 1449.

The United States of America to all to whom these letters-patent shall come:

Whereas, Wm. F. Ladd, of New York, New York, and Morris L. Keen, of Philadelphia, Pennsylvania, assignees, (through mesne assignments,) of Charles Watt and Hugh Burgess, of London, England, have alleged that said Charles Watt and Hugh Burgess invented a new and useful improved process of treating wood and other vegetable substances, in the manufacture of paper-pulp, (for which letters-patent were issued to them, dated July 18, 1854, and antedated August 19, 1853, the same surrendered by said assignees, and new letters issued to them on an amended specification, dated October 5, 1858, which last letters having been surrendered by them, the same have been cancelled, and new letters ordered to issue to them on two separate amended specifications,) which they stated had not been known or used before

their application; had made oath that they were subjects of the Queen of Great Britain; that they did verily believe that they were the original and first inventors or discoverers of the said invention; and that the same hath not, to the best of their knowledge and belief, been previously known or used, said Ladd and Keen having paid into the Treasury of the United States, the sum of thirty dollars, and presented a petition to the Commissioner of Patents, signifying a desire of obtaining an exclusive property in the said invention, and praying that a patent may be granted for that purpose:

These are, therefore, to grant according to law, to the said William F. Ladd and Morris L. Keen, their heirs, administrators, or assigns, for the term of fourteen years, from the 19th day of August, one
26 thousand eight hundred and fifty-three, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said invention, a description whereof is given in the words of the said Ladd and Keen, in the schedule hereunto annexed, and is made a part of these presents.

In testimony whereof, I have caused these letters to be made patent, and the seal of the Patent-Office has been hereunto affixed.

Given under my hand at the city of Washington, this seventh day of April, in the year of our Lord one thousand eight hundred and sixty-three, and of the Independence of the United States of America the eighty-seventh.

(Signed) J. P. USHER,
Secretary of the Interior.

Countersigned and sealed with the seal of the Patent-Office.

(Signed) D. P. HOLLOWAY,
Commissioner of Patents.

The schedule referred to in these letters-patent and making part of the same.

To all whom it may concern:

Be it known, that Charles Watt and Hugh Burgess, of London, England, did invent, make, and apply to use, certain improvements in pulping and disintegrating wood and other vegetable substances, for which letters patent were granted to them by Her Majesty the Queen of Great Britain, bearing date the 19th of August, 1853, and we do hereby declare that the following is a full, clear, and exact description of said invention, and of the mode of carrying out the same in practice.

The wood or vegetable substances upon which it is intended to operate by this process, should first be reduced to fine shavings or cuttings. This may be done in any suitable machine.

27 The shavings or cuttings of wood, or the vegetable substances, are then to be boiled in a solution of caustic alkali, in a suitable boiler, under pressure. The strength of the alkali is dependent upon the nature of the vegetable substance used and operated upon. For non-resinous woods, a solution of alkali of the strength indicated by 17° of the English hydrometer, or thereabouts, answers very well; and for deal, pine, or fir-wood, or other woods containing resinous matter, a strength of about 12° is sufficient, but varying with the nature of the vegetable substance being acted upon, to a strength of about 10 deg. The varied nature of the vegetable substance to be acted upon, is such that only general directions can be given for the strength of the alkali, or the degree of heat to be used, or the duration of the operation. Boil-

ing in a solution of caustic alkali, under pressure, is of essential import-
65 lbs. 301 3°. ance. By the words "under pressure," is meant a pressure at,
60 " 295 6 near, or above 300 degs. of Fahrenheit's scale, which is the
70 " 306 4
75 " 311 2 ordinary pressure used; but a heat and corresponding pressure
80 " 315 8 of from 300 to 500 degrees may be used, according to the nature of the vegetable substance to be treated, whether resinous or non-resinous, or otherwise, and the time may be from four to twelve hours, according to the nature of the substance.

After the vegetable substance has been thus operated upon by caustic alkali, under heat and pressure for the requisite time, as above described, it should be discharged from the boiler, while under pressure, into a tank or other reservoir, with proper safety-valves and pipes for the discharge of the steam, and should be drawn, as soon as the steam shall have escaped, into open vats, where it can be operated upon in the next stage of the process, *as* it may be drawn directly into the vats from the boiler. The vats which receive the wood shavings or cuttings, or other vegetable substances being formed into pulp should be constructed with suitable means of drainage.

The alkaline solutions must then be removed from the pulp, either by percolation and subsequent washing in the vats, or by pressure in any convenient apparatus and subsequent washing. The mode of percolation has generally been found sufficient. The alkaline solutions thus obtained may be saved, and evaporated down, and the residuum
28 burned in a furnace suitably constructed, so as to prepare the alkaline substances for use in a repetition of the same process.

The alkaline solution having been removed by percolation and washing, or by pressure and washing, the wet mass of woody or vegetable pulp is now to be exposed to the action of chlorine or the compounds of chlorine with oxygen, for the purpose of bleaching it, and preparing it for the manufacture of white paper. Brown, colored, or unbleached paper of a good quality can be produced from the pulp as soon as the alkaline solutions are removed, but for the production of good white paper, it is necessary to subject the pulp to the bleaching process.

If the material used be wood, or vegetable substance of a non-resinous nature, the pulp may be bleached by subjecting it to the action of chlorine in a gaseous form, or, which is preferable in this case, in an aqueous solution, in any of the common and well-known modes.

If the wood or vegetable substance be of a resinous nature, the alkaline solution should be removed by the mode above described, and the pulpy mass should be exposed to the action of chlorine, or its compounds with oxygen. This may be done by placing the pulpy mass of woody or vegetable substance on racks or drawers arranged in a chamber, and applying chlorine, or its compounds with oxygen in the gaseous form, which, with resinous substances, is preferable to the aqueous solution, until the mass is sufficiently acted upon. The mass must then be again well washed, and treated with a weak solution of caustic alkali, warm preferred, which changes the red color to a dark brown. The alkaline solution should then be removed by washing, and the resulting grey pulp may be bleached by any ordinary method of bleaching.

What we claim as the invention of Charles Watt and Hugh Burgess is, first—

The process of treating wood or other vegetable substance by boiling in an alkali under pressure as a process, or preparatory process for making pulp for the manufacture of paper from such woods, or other vegetable substances, substantially as described.

29 We also claim the process of treating resinous woods by boil

ing in an alkali, under pressure, and treating the product with chlorine and its compounds with oxygen, for making white pulp, for the manufacture of paper from such woods, substantially as described.

(Signed) WILLIAM F. LADD.

Witnesses to W. F. Ladd—
JONATHAN S. ODELL.
SAMUEL COLES.

(Signed) MORRIS L. KEEN.

Witnesses to M. L. Keen—
GEORGE C. WARD.
PATRICK WARD.

30 EXHIBIT "C."

Know all men by these presents that we, William F. Ladd, of Tarrytown, Westchester County, and State of New York, and Morris L. Keen, of Rogers' Ford, County of Montgomery, and State of Pennsylvania, in consideration of the sum of one dollar and other valuable considerations received, to our full satisfaction, of Benjamin Buffum, of the city and county of Providence, and State of Rhode Island, trustee for the American Wood-Paper Company, do hereby bargain, sell, assign, transfer, and convey unto said Benjamin Buffum, trustee as aforesaid, and to said American Wood-Paper Company, their successors, and assigns, all our right, title, and interest, in and to letters-patent of the United States, originally granted to Charles Watt and Hugh Burgess, of London, England, dated July 18th, A. D. 1854, antedated August 19th, A. D. 1853, and by the said Charles Watt and Hugh Burgess, assigned to Frederic B. Houghton, by indenture made November 22d, A. D. 1854, and by the said Frederic B. Houghton, on the 20th day of March, A. D. 1855, by indenture assigned to us the grantors, and by us surrendered, and new letters issued to us on an amended specification, dated October 5th, 1858, and again by us surrendered, and again re-issued to us in two letters-patent, numbered re-issue No. 1448 and re-issue No. 1449, bearing date the seventh day of April, A. D. 1863, which re-issued letters-patent are entitled as follows: No. 1448, "for improved pulp from wood, &c., for the manufacture of paper," and No. 1449, "for improved process of treating wood and other vegetable substances in the manufacture of paper-pulp," our said right, title, and interest in said re-issued letters-patent, being the entire title thereto: To have and to hold the said re-issued letters-patent to the said Buffum, trustee as aforesaid, and to said American Wood-Paper Company, their successors and assigns, with all rights and things incident thereto, or growing out of the same, and all claims for damages or profits
31 against all infringers of said re-issued letters-patent, for, and during the period from the dates of said re-issued letters, till the expiration of the term for which said letters-patent were originally granted, and for such other terms or periods as we have a right in or title to the same.

And we do hereby constitute and appoint the said Benjamin Buffum, trustee as aforesaid, and the said American Wood-Paper Company, their successors and assigns, our true and lawful attorney, and attorneys, to claim, demand, sue for and recover to their use, any and all damages or profits to which we may be entitled, for infringement of said re-issued letters-patent, the same being done without expense to us.

In testimony whereof, we have hereunto set our hands and seal, this

eighteenth day of May, A. D. eighteen hundred and sixty-three, at our several places of residence as hereinbefore mentioned.

(Signed) W'M F. LADD. [L S.]
MORRIS L. KEEN. [L S.]

Executed and delivered in presence of—
Witness signature of Morris L. Keen—
W'M GOODWIN.
JOHN FARREL.
Witness signature of W'm F. Ladd—
A. J. DELATOUR.
GEORGE W. WILLS.

U. S. PATENT OFFICE.

Received and recorded Oct. 23, 1863, in liber D 7, page 113, of transfers of patents.

In testimony whereof I have caused the seal of the Patent-Office to be hereunto affixed.

(Signed) D. P. HOLLOWAY,
Comm'r of Patents.

32 EXHIBIT "D."

Whereas, William F. Ladd, of Tarrytown, Westchester County, and State of New York, and Morris L. Keen, of Rogers' Ford, county of Montgomery, and State of Pennsylvania, by instrument in writing bearing date eighteenth day of May, A. D. eighteen hundred and sixty-three, conveyed to Benjamin Buffum, of the city and county of Providence, State of Rhode Iland, as trustee for the American Wood-Paper Company, all their right, title, and interest in and to letters-patent of the United States, originally granted to Charles Watt and Hugh Burgess, of London, England, dated July 18th, A. D. 1854, antedated August 19th, A. D. 1853, and by the said Charles Watt and Hugh Burgess assigned to Frederick B. Houghton, by indenture made November 22d, A. D. 1854, and by the said Frederic B. Houghton, on the 20th day of March, A. D. 1855, by indenture assigned to them, the grantors, and by them surrendered, and new letters issued to them, on an amended specification, dated October 5th, A. D. 1858, and again by them surrendered, and again re-issued to them in two letters-patent, numbered re-issue No. 1448 and re-issue No. 1449, bearing date the 7th day of April, A. D. 1863, which re-issued letters-patent are entitled as follows: No. 1448, "for improved pulp from wood, &c., for the manufacture of paper," and No. 1449, "for improved process of treating wood and other vegetable substance in the manufacture of paper-pulp," their said right, title, and interest in said re-issued letters-patent, being the entire title thereto:

Now, therefore, I, the said Benjamin Buffum, in consideration of one dollar and other valuable considerations received, to my full satisfaction, from said American Wood-Paper Company, a corporation created by the general assembly of the State of Rhode Island, do hereby transfer and convey unto said corporation, their successors and assigns,
33 all the right, title, and interest in said letters-patent and in the improvements therein described, conveyed to me as trustee by the instrument aforesaid, and I do hereby substitute the aforesaid American Wood-Paper Company, their successors and assigns to all powers, rights, and privileges granted to me by the instrument afore-

said, and secured to me by the covenants therein contained and set forth.

In testimony whereof I have hereunto set my hand and seal, this sixteenth day of June, A. D. eighteen hundred and sixty-five.

(Signed) BENJAMIN BUFFUM. [L S.]

Executed and delivered in presence of—

ALFRED K. HALL.
ALFRED R. KING.

34 EXHIBIT "E."—No. 17387.

The United States of America to all to whom these letters-patent shall come:

Whereas Marie Amédée Charles Mellier, of Paris, France, has alleged that he has invented a new and useful improvement in making paper-pulp, which he states has not been known or used before his application; has made oath that he is a citizen of France; that he does verily believe that he is the original and first inventor or discoverer of the said improvement, and that the same hath not, to the best of his knowledge and belief, been previously known or used; has paid into the Treasury of the United States the sum of three hundred dollars, and presented a petition to the Commissioner of Patents signifying a desire of obtaining an exclusive property in the said improvement, and praying that a patent may be granted for that purpose:

These are, therefore, to grant according to law, to the said Marie Amédeé, Charles Mellier, his heirs, administrators, or assigns, for the term of fourteen years from the 7th day of August, one thousand eight hundred and fifty-four, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said improvement, a description whereof is given in the words of the said Mellier in the schedule hereunto annexed, and is made a part of these presents.

In testimony whereof, I have caused these letters to be made patent, and the seal of the Patent-Office has been hereunto affixed.

35 Given under my hand at the city of Washington this twenty-sixth day of May, in the year of our Lord one thousand eight hundred and fifty-seven, and of the Independence of the United States of America the eighty-first.

(Signed) JACOB THOMPSON,
Sec'y of the Interior.

Countersigned and sealed with the seal of the Patent-Office.

(Signed) C. MASON,
Commissioner of Patents.

The schedule referred to in these letters-patent and making part of the same.

To all whom it may concern:

Be it known that I, Marie Amédeé Charles Mellier, of Paris, in the Empire of France, have made an invention for an improvement in the manufacture of paper, and I do hereby declare that the following is a full and exact description:

The invention has for its object a peculiar process for the treating of straw and other vegetable fibrous materials requiring like treatment preparatory to the use of such fibres in the manufacture of paper; and the improvement consists in subjecting straw or such other fibrous

materials to a pressure of at least seventy pounds on the square inch, when boiling such fibrous matters in a solution of caustic alkali. For this purpose the straw or fibrous matters are cut into short lengths, soaked in warm water, and washed. They are then placed in a suitable boiler; and I use for such purpose a rotary boiler, provided with a coil or coils of steam-pipe for the purpose of heating the contents, and I prefer that the boiling should be carried on at a temperature to produce at or above eighty pounds on the square inch in the boiler where are the fibrous materials to be acted upon. But so high a temperature is not absolutely necessary; for I have found, by experiment, that it is essential that a temperature equivalent to seventy pounds on the square inch must be employed. The quantity of alkali used is at the
36 rate of about sixteen per cent. of caustic soda or potash of the straw of fibrous substance under process. The fibres may then be bleached by the use of a comparatively small quantity of bleaching powder or chloride of lime.

To enable others skilled in the art to make and use my invention, I will proceed to describe more fully the manner of using the same. The straw or other fibrous material requiring a like process to prepare the same for the paper manufacture, is first, as heretofore, to be cut in a chaff-cutting or other machine into short lengths, and to be freed from knots, dirt, and dust, and then steeped for a few hours in hot water. The straw or fibrous materials and a weak solution of caustic alkali, are then to be placed in a suitable close boiler, heated by steam, as hereafter explained, and the heat is to be raised to such a degree as to attain and maintain for a time, a pressure internally of the boiler equal to or exceeding seventy pounds on the square inch, that is, about 310° of Fahrenheit, by which means a considerable saving of alkali, as well as time and fuel, results, as compared with the means of using a hot solution of caustic alkali, as now practiced in preparing straw and other fibres for paper-makers. The boiler employed for the purpose, and the manner of heating it by steam may be varied. But first, it must have a rotary motion either on its long or on its small axis, by means which are very well known; and secondly I prefer not to send the steam directly into the liquid in which the materials are immersed, but to pass it either in a jacket around the boiler, or through a coil or a system of steam-pipes inside of it, so that the steam does not mix with the caustic alkaline solution in the middle portion of the boiler, but is kept separate, and does not, therefore, in condensing, dilute the caustic alkaline solution used. The plan of construction of the boiler I would recommend would be, if the boiler is to rotate vertically or on its small axis, as very well known, to cover it with a jacket so that the steam could circulate from one end to the other between the two plates, or rather, if it is to revolve horizontally or upon its long axis, as is equally very well known, to fix near each end of the boiler, and inside of it, a diaphragm or partition, which partitions are connected to-
37 gether by numerous tubes, which are arranged in a circle near the outer circumference of each partition. By this arrangement the steam is introduced through the hollow axis at one end of the boiler, and it passes through the steam-pipes, and thence into the compartment at the other end of the boiler, where it and the condensed steam are conveyed away, as is understood, through the other hollow axis. In adopting the plan of not sending directly the steam into the boiler, I found the three following advantages: 1st, not to dilute, as I have already said, the alkaline solution; 2d, to avoid the trouble of having sometimes the end of the steam-pipe in the boiler choked with

straw, and to prevent, in case that by one cause or another, the pressure in the steam-boiler would fall under the degree of the pressure in the straw boiler, the priming of the first by the second, viz., the absorption of straw and alkaline solution from the straw-boiler into the steam boiler; 3d, the greater facility of cooling the straw boiler when the pressure has been maintained for a sufficient length of time, by means of turning off the steam at one end, letting it at the other end out of the jacket or of the coils or steam-pipes just described, and passing through the same a stream of cold water, which, at the same time that it cools the mass, furnishes a quantity of cold water, which can be received in convenient vessels, and will be found very useful for washing the straw or other fibrous materials after boiling.

By means of submitting the straw or similar fibrous materials to a pressure of between 70 to 84 pounds on the square inch inside of the boiler, I can reduce considerably the proportion of alkali; and the solution which I prefer to use is to be from two to three degrees of Baumé, or of a specific gravity, of from 1,013 to 1,020, and at the rate of about 70 gallons of such solution to each cwt. of straw or other fibrous vegetable matters requiring like treatment.

The boiler is to be filled with straw and alkaline solution, and then closed fluid and steam tight. The boiler is made to revolve slowly, say about one or two revolutions per minute, and the steam is to be admitted. I find it desirable to keep up the heat and pressure during about three hours after the pressure above mentioned has been obtained when the process of boiling is complete. A steam-gauge properly
38 fixed upon the boiler will enable one to ascertain when the pressure has attained the required degree. When the apparatus and the fibres under process have been cooled by means hereinbefore mentioned, or rather when the pressure has been reduced to nothing, I open the manhole of the boiler, empty the materials in suitable vessels, and wash them first with hot water, then with cold water, until the liquor runs perfectly clear. I then steep the fibre for about an hour in hot water acidulated with a quantity of sulphuric acid, equal to about two per cent. of the weight of the fibres under process, and finally the washing is completed with cold water. The straw or fibre may then be bleached in the ordinary manner, and it will be found to be accomplished by a comparatively small quantity of chloride of lime.

Having thus described the nature of my said invention, and the manner of performing the same, I would have it understood that I do not claim the general use of caustic alkaline solutions nor the employment generally of a close boiler for boiling straw or other vegetable fibrous substances.

But what I claim as my invention, and desire to secure by letters-patent, is the use of a solution of caustic soda (Na °) in a compartment of a rotary vessel separate from that which contains the steam-heat, substantially as described.

I also claim the within-described process for bleaching straw, consisting in boiling it in a solution of pure caustic soda (Na °) from 2° to 3° Baumé, at a temperature not less than 310° Fahrenheit, after it has been soaked and cleaned, and before submitting it to the action of a solution of chloride of lime from 1 to 1½ degrees, substantially as described.

(Signed) A. M. MELLIER.

Witnesses—

ALLERME.

E. MARZEY.

39 EXHIBIT "F."

Know all men by these presents, that I, Marie Amédeé Mellier, of New York, have made, constituted and appointed, and do hereby make, constitute, and appoint Victor Beaumont, civil engineer, of New York, for my lawful attorney, for me and in my name, place, and stead, to manage, use and sell, and to do all and everything whatsoever in and about, or resulting from the management, use, and sale of my letters-patent issued or to be issued by the Government of the United States to me, in whole or in part, and any part of any such letters-patent and of any invention or improvement patented thereby, and the right to use the same, and for that purpose to make, sign, seal, execute, and deliver all and every deed or other instrument under seal or otherwise, giving and granting to my said attorney full power and authority to do and perform all and every act and thing whatsoever, requisite and necessary to be done in and about the premises, as fully to all intents and purposes as I might or could do if personally present, with full powers of substitution and revocation, I hereby ratifying and confirming all that my said attorney or his substitute or substitutes shall lawfully do or cause to be done by virtue hereof.

In witness whereof I have hereunto set my hand and seal, the 23d day of June, in the year one thousand eight hundred and fifty-four.

(Signed) M. A. C. MELLIER. [L. S.]

Signed, sealed, and delivered in presence of—
WILLIAM HENRY WALLACE.
EDWARD GIFFORD.

CITY AND COUNTY OF NEW YORK, *ss:*

On this 23d day of June, A. D. 1854, before me personally
40 came Marie A. D. Mellier, known to me to be the person described in and who executed the foregoing power of attorney, who acknowledged to me that he executed the same.

DAVID J. CHATFIELD,
Comm'r of Deeds.

Mr. O'BRIEN.

U. S. PATENT-OFFICE.

Received and recorded March 15th, 1862, in liber L 6, page 279, of transfers of patents.

In testimony whereof I have caused the seal of the Patent-Office to be hereunto affixed.

D. P. HOLLOWAY,
Comm'r of Patents.

41 EXHIBIT "G."

Whereas I, Marie Amédeé Charles Mellier, of Paris, France, did obtain letters-patent of the United States for certain improvements in making paper-pulp, which letters-patent bear date the 26th day of May, 1857; and whereas Coe S. Buchanan, of Saratoga County, and State of New York, has purchased of me the right to use said patent for and in the whole of the United States of America and Territories: Now this indenture witnesseth that, for and in consideration of money already advanced, amounting to about fourteen hundred dollars, ($1,400,) by the said Coe S. Buchanan to said Marie Amédeé Charles Mellier, the par-

ties to this instrument; and in consideration of the said Buchanan paying and agreeing to pay the said Mellier one-half of the net receipts of said patent in the sales of rights to use the same in any and all places in the United States, I have assigned, sold, and set over, and do hereby assign, sell, and set over unto the said Coe S. Buchanan, all the right, title, and interest which I have in the said invention as secured to me by the said patent for, to, and in the United States of America and its Territories: The same to be held and enjoyed by the said Coe S. Buchanan for his own use and behoof, and for the use and behoof of his legal representatives, to the full end of the term for which said letters-patent are or may be granted, as fully and entirely as the same would have been held and enjoyed by me had this assignment and sale not been made.

In testimony whereof I hereunto set my hand and affix my seal, this nineteenth day of June, A. D. 1857.

A. MELLIER,
By V. BEAUMONT, [L. S.]
Attorney.

Sealed and delivered in presence of—
JOS. HENRY NASH, 36 *Beekman St.*

42 STATE, CITY, AND COUNTY OF NEW YORK, *ss:*

On this 19th day of June, A. D. 1857, personally appeared before me Victor Beaumont, known to me to be the same person who executed the foregoing instrument, who acknowledged that he executed the same as the act and deed of A. Mellier therein described, by virtue of a power of attorney, duly executed by the said A. Mellier, bearing date the 23d day of June, A. D. 1854, and acknowledged before a commissioner of deeds on the same day.

JOS. HENRY NASH,
Comm'r of Deeds, 36 *Beekman St.*

U. S. PATENT-OFFICE.

Received June 25, 1857, and recorded in liber M 4, page 98, of transfers of patents.

In testimony whereof I have caused the seal of the Patent-Office to be hereunto affixed.

C. MASON,
Comm'r of Patents.

43 EXHIBIT "H."

In the circuit court of the United States for the northern district of New York, in the second circuit.

COE S. BUCHANAN
vs.
GARDNER HOWLAND AND JOSEPH B. PALSER. } In equity.

Messrs. Tiffany & Keller, for plaintiff.
Messrs. Gale, & Beach, for defendants.

HALL, *District Judge:*

This suit is founded on letters-patent granted to Marie Amédeé Charles Mellier, of Paris, France, on the 26th of May, 1857, for fourteen years from the 7th day of August, 1854, for "a new and useful improvement in making paper-pulp."

The bill alleges an infringement of the rights of the plaintiff, as the assignee and owner of this patent; and it prays a permanent injunction, and an account of profits, substantially in the accustomed form.

The specifications annexed to these letters-patent is in the following words:*

The answer of the defendants admits the letters-patent and the assignment thereof to the plaintiff, and also, that "the said Amédeé invented the particular mode in said letters-patent described, (to wit, by two separate steam-tight compartments,) of separating the steam-heat from such material whilst boiling the same, in a rotary vessel, in
44 a solution of caustic alkali; and, also, invented the soaking and cleaning of such material, before boiling the same in a solution of caustic alkali;" but it denies that the said Amédeé was the inventor of any other idea, process, or improvement. In respect to the residue of the process patented, the defendants' answer alleges that the same was not novel, and it denies the alleged infringements of the patent. It also denies the utility of the invention.

The defendants also set up letters-patent, granted to themselves on the 20th day of March, 1860; and other letters-patent, granted to them on the 3d day of July, 1860, and claim that their operations were carried on under such patents and without the use of the invention of Amédeé, and without the infringement of his patent.

It was conceded at the hearing that there had been no trial at law on which the validity of the patent, under which the plaintiff proceeds, had been established; and also, that no preliminary injunction had been granted or even applied for, in this suit.

It was therefore insisted, on behalf of the defendants, that no relief could be granted to the plaintiff; that the issues upon which the validity of the patent depends are triable only at law; and, that because the plaintiff had not applied for the trial at law, of proper issues to determine the validity of his patent and its infringement, this court should now dismiss his bill, with costs.

In support of these positions, the counsel cited Curtis on Patents, (sections 314, 315, and note 1, 328, 336, and note 1;) and Bacon vs. Jones, (4 Mylne & Craig, 433.) These sections of Mr. Curtis' valuable work, so far as they relate to the question now under consideration, are based mainly upon the case of Bacon vs. Jones, and must therefore be considered in connection with the full report of that case. By that report it appears that the lord chancellor, after speaking of applications for injunctions before the final hearing, said: "When the cause comes to a hearing, the court has also a large latitude left to it; and I am far from saying that a cause may not arise in which, even at that stage, the court will be of the opinion that the injunction may be properly granted without having recourse to a trial at law. The conduct and dealing of the parties, the frame of the pleadings, the nature of the patent
45 right, and of the evidence by which it is established—these and other circumstances may combine to produce such a result; although this is certainly not very likely to happen, and I am not aware of any case in which it has happened. Nevertheless it is a course unquestionably competent to the court, provided a case can be presented which satisfies the mind of the judge that such a course, if adopted, will do justice."

In the report of the same case before the master of the rolls, (the report in Mylne & Craig is of the hearing and decision before the lord

* See copy of specification attached.

chancellor, on appeal,) the master of the rolls is reported to have said, (1 Beavans' Rep., 387:) "I think that, if a plaintiff be entitled to an injunction on the merits and on the evidence produced at the hearing, he is not to be deprived of that right because he has not moved for an injunction at a previous stage of the cause." (And see Bailey vs. Taylor, 1 Russell & Mylne, 76; Isaacs vs. Cooper, 4 Washs. C. C. Reps., 259; Wilson vs. Tindal, Webster's Patent Cases, 739, note; Hindmarch on Patents, 356.)

It is apparent from the reports of the case of Bacon vs. Jones, and other English cases, that, even in the English courts there is no inflexible rule requiring a court of equity to refuse a permanent injunction upon a final hearing, on the grounds urged in this case; and certainly the American practice has not been such as to sustain the positions of the defendants' counsel. The case of Goodyear vs. Day, (2 Wallace, jr., 283,) is a case, in many of its features, somewhat like the present; and the opinion of the court, as delivered by Mr. Justice Grier, states, very briefly, the practice of our courts, in respect to this question, and presents his reasons for proceeding to the final disposition of the cause without requiring the verdict of the jury; reasons which apply with such force in the present case.

In the case of Goodyear vs. Day, above referred to, Mr. Justice Grier, in delivering the opinion of the court, said: "It is true that in England the chancellor will generally not grant a final and perpetual injunction in patent cases, when the answer denies the validity of the patent, without sending the parties to law to have that question decided."

But even there the rule is not absolute or universal: it is
46 a practice founded more on convenience than necessity. It always rests in the sound discretion of the court. A trial at law is ordered by a chancellor to inform his conscience; not because either party may demand it as a right, or that a court of equity is incompetent to judge of questions of fact or of legal titles. In the courts of the United States the practice is by no means so general as in England, or as it would be here if the trouble of trying issues at law devolved upon a different court."

Cases involving inquiries into the most complex and difficult questions of mechanics and philosophy are becoming numerous in the courts. Often questions of originality and infringement of patents, do not depend so much on the credibility of witnesses or the weight of oral testimony, as on the application of principles of science and law to admitted facts. It is true that, in matters of opinion, both mechanics and learned professors will differ widely; but still the question is not to be decided by the number, the credibility, or respectability of such witnesses, but by the force of the reasons given for their respective opinions. It is no reflection on the trial by jury to say, that cases frequently occur, in which ten out of twelve jurors do not understand the principles of science, mathematics, or philosophy necessary to a correct judgment of the case. Besides, much of the time of courts is lost, where twelve men will not agree upon a verdict; or where they have agreed, the conscience of the chancellor, instead of feeling enlightened, rejects it altogether.

A select or special jury of philosophers, if they could be got, would perhaps not prove more satisfactory, or obviate the difficulty.

In a late case, involving the validity of Morse's telegraph patents, which was heard in Philadelphia, a final injunction was decreed without a verdict to establish the patents; and many other cases might be cited from other circuits, if necessary, in support of the practice, showing

that the courts of the United States do not always consider it a proper exercise of their discretion to order such issues to be tried at law before granting a final injunction.

In the present case there are many reasons why the court will not thus exercise their discretion:

47 1st. Because this case has been set down for final hearing on the exhibits and proofs, without any motion or order of the court for such an issue.

2d. After a patient hearing of very able counsel, and a careful consideration of the testimony, the court feel no doubt or difficulty on these questions, which would be removed or confirmed by a verdict.

3d. It would require three or four weeks at least to try this case before a jury if this library of testimony were read to them; and at least as many months if the witnesses were examined viva voce, as they probably would be; and after all this expenditure of time and labor, it is even more than probable that from the confusion created by the great length of the testimony and argument in court, or the force and effect of those urged from without, no verdict would be obtained, and most certainly none that would alter the present conviction of the court.

The answer of the defendants, in Goodyear vs. Day, not only denied the allegations of the bill, but concluded by praying "a trial by jury of the various issues of fact formed by it." The defendant did not, however, make any special motion for the trial of such issues, by jury; and this it had been seen was considered by the court as a prominent ground for proceeding to the final determination of the cause without a trial at law.

In this case no prayer for a trial by jury is to be found in the answer, and no special motion for such trial has been made.

The nature of the patent-right in this case and the character of the evidence by which it is to be established or overthrown, are such that I am quite satisfied that, upon the most important questions involved, the conclusions of a judge, based upon repeated examinations and comparisons of depositions carefully taken, reduced to writing, read to and approved by the deponents, after a full cross-examination, would, as a general rule, be more accurate and reliable than the verdict of a jury, which must of necessity be based upon the hasty oral-examination of witnesses at a circuit, and made, in the usual manner, after only a brief consultation.

48 It is true that, in regard to the ordinary transactions of life, with which jurors are more familiar, the verdict of a jury is, and ought to be, more relied upon than *than* the opinion of a judge, formed during the progress of a trial; but we are not satisfied that an ordinary jury would be the best tribunal to decide upon the questions of fact in this case—questions upon which the very full and yet conflicting testimony of the scientific experts may exercise a very considerable if not a controlling influence. This testimony ought to be attentively examined, and the testimony of each witness carefully compared with that of every other, and the general facts of the case; and the whole evidence ought then to be made the subject of deliberate consideration. This can be better done by a judge in vacation than by a jury at term; and, as a general rule, a judge is better qualified than an ordinary jury to investigate and determine disputed questions depending in part on the principles and facts of chemistry and of natural philosophy. The case will therefore be examined and disposed of without requiring the intervention of a jury.

In disposing of the case upon its merits, we shall first consider the

specification and claim of the complainant's patent, with a view of determining the character and extent of the invention patented.

The first claim is in these words: "What I claim as my invention, and desire to secure by letters-patent, is the use of a solution of caustic soda (Na °) in a compartment of a rotary vessel, separate from that which contains the steam-heat, substantially as described."

This claim is in one sense a very broad one, as it does not (unless limited by the words "substantially as described") restrict the claim to the use of a solution of caustic soda of any indicated degree of strength, to the use of an extraordinary degree of heat, or to any particular form or mode of construction of a comparted rotary vessel, if its construction be such as to make it suitable for the purpose indicated. In another respect it may be quite limited, for (even when considered alone and without reference to the claim which immediately follows it) it is at least doubtful whether it extends to any use of the solution indicated, except in a vessel with compartments so constructed and arranged
49 that the solution is used in a compartment separate and distinct from that which contains the steam-heat by which the solution is to be heated.

This claim is substantially for a process, that is, for the use of a solution of caustic soda (Na°.) in a compartment of a rotary vessel, separate from that in which the steam-heat is confined when applied, for the purposes indicated; and looking to the whole specification and the claims annexed, and especially to the distinct language which expressly limits the process thus claimed to the use of a solution of caustic soda in a compartment of a vessel separate and distinct from another compartment, by means of which the required steam-heat is confined and applied, and to the more general and comprehensive terms of the claim which immediately follows it. I am inclined to think this claim cannot be held to extend beyond the use of a vessel with separate compartments for the material to be heated, and for the steam-heat used in the process, substantially as specified. Such a vessel the defendants do not use, and therefore do not infringe the claim of the patent.

It was urged by the counsel for the plaintiff that the use of the designated solution, in a rotary boiler without compartments, and heated by a fire under or around the same, was but the substitution of fire-heat as a well-known equivalent of the steam-heat used by the patentee; but as neither degree of heat, nor strength of solution is specified in this claim, and as it, in terms, expressly requires the use of steam-heat in one compartment of a vessel, with two or more compartments, in the other of which the material to be heated is to be placed, we shall hold that this claim of the plaintiff's patent does not extend to, and is not infringed by the use of the solution of caustic alkali in a simple single-chambered rotary boiler, heated by fire-heat, under or around the frame, as practiced by the defendants. And this construction of the first claim of the patent is, we think, very clearly indicated by the different character of the second claim, which is broader in its terms, and embraces the use of the process invented by Mellier without regard to the mode of applying the heat, or the particular form or construction, or arrangement of
50 the rotary boiler or apparatus by which the process may be carried on for the purposes indicated.

The second claim in the plaintiff's patent is in these words: "I also claim the within-described process for bleaching straw, consisting in boiling it in a solution of pure caustic soda (Na°.) from 2° to 3° Baumé, at a temperature of not less than 310° Fahrenheit, after it has been soaked and cleansed, and before submitting it to the action of chloride of lime, from 1 to 1½ degrees, substantially as described."

It is evident that the process thus claimed includes only the specified boiling of the material treated in the solution, and under the conditions specified, and that the prior soaking and cleansing of such material, and subsequent treatment of it, by submitting it to the action of chloride of lime, as specified, are not a part of the process thus claimed. The soaking of the straw or other material to be heated like the cutting of it into short lengths and freeing it from dirt and dust; the subsequent washings of the material in hot and cold water; and the bleaching of the cleansed fibre by a comparatively small quantity of chloride of lime, after steeping it in warm water acidulated by sulphuric acid, are not portions of the process claimed and patented; for the patentee, at the commencement of the specification, says, his "improvement consists in subjecting straw or other fibrous materials, to a pressure of at least seventy pounds on the square inch, when boiling such fibrous matters in a solution of caustic alkali;" and the claim, as has been seen, states the process for bleaching straw, claimed in the second claim, as consisting in boiling it, "under the presented conditions, after it has been soaked and cleansed, and before submitting it to the action of a solution of chloride of lime," &c.; thus limiting the process to the boiling, under the conditions thus indicated.

The real discovery of Mellier, the main idea, the spirit or principle of his invention, was, that the known effects of a solution of pure caustic soda, which had been previously advantageously used for boiling straw and other fibrous materials of similar character and texture, in open vessels, in which the heat could be raised only to 212° Fahrenheit,
51 might, by the use of a much higher degree of heat, not less than 310° Fahrenheit, be advantageously and greatly increased; while the lessening of the time the fibre was subjected to the action of the caustic alkaline solution, and the use of the weaker solution, which could thus be advantageously used, would be less injurious to the fibre, as well as more economical in its use and application. This was the discovery or principle to be developed and practically applied, and he embodied that principle and arranged and described the means of its practical application, for the purposes specified in the mode and manner particularly described in his specification. This mode, he says, he prefers, and he recommends a particular construction of the boiler as proper to be used in the practical application of the leading idea and principle of his invention. But, aware that inferior forms may be devised by any mechanic, and that superior forms and modes of construction and application may be devised after the use of his process has become familiar, he very wisely makes his second claim broad enough to cover his actual discovery and invention, irrespective of the particular form or construction of the vessel in which the boiling process might be carried on.

The invention and patent are in some respects like those of Neilson for the application to the blast-furnace of air heated to an extreme degree in a separate vessel intermediate the blowing-apparatus and the point where it enters the furnace. In Neilson vs. Hartford, the learned Baron Alderson, in respect to Neilson's invention and patent said: "The blowing-apparatus was perfectly well known; the heating of air was perfectly well known as applicable to blast-furnaces; then what he really discovered is, that it would be better for you to apply air heated up to a red-hot heat, or nearly so, instead of cold air, as you have hitherto done. That is the principle—that is the real discovery; but in order to take out a patent you must have an embodiment of the principle, and his embodiment of the principle is the heating of air in a separate vessel immediately between the blowing-apparatus and the point where it enters

the furnace." Then he says, "I do not mean to claim any shape in which it is done. It may be done in a vessel of any shape, provided only you have a vessel of such a shape, and fire so applied as that, in the
52 intermediate spaces between the blowing apparatus and the furnace, the air arrives at the red heat." (Webster's Patent Cases, 337; and see the opinion of Lord Justice Clerk Hope on the same patent, ibid, 683–685.)

It was strongly urged by the defendant's counsel that "the language of the second claim excludes the idea of every temperature exceeding 310° Fahrenheit;" and it was said, "The term 'of not less than 310° Fahrenheit' has no reference to higher degrees. It names a specific temperature, and provides against less, without including more. The phrase 'not less than' fixes a minimum limit, without regard to a maximum."

If this position is well taken, and can be maintained in all its strictness, then most surely the patentee is limited to the precise heat of 310°, and any one may use what is substantially his process, with impunity, provided the heat employed is a few degrees above or below the standard thus set up. But we think this position cannot be maintained. It is entirely clear that such was not the intention of the patentee or of the person who drew this specification, for neither could have intended so to limit the claim of the patent as to render it of no practical value. The discovery made was that the higher degrees of heat and pressure could produce the desired result; and, while the minimum heat requisite to produce a really beneficial result was stated, no upward limit was fixed so long as the process carried on by that degree of heat was, in fact, a boiling process, under the conditions, in substance, as stated in the specification.

But it was urged that the Mellier patent was at all events limited to the pressure not exceeding 84 pounds to the square inch, because, in his specification, he says that by the use of that pressure he can reduce considerably the proportion of alkali. We think this languaage does not limit the claim, and that, notwithstanding this language in the specification, the proper construction of the claim is as above stated. Nor do the statements in the specification, that the patentee prefers "that the boiling should be carried on at a temperature to produce at or above 80 pounds pressure on the square inch in the boiler, where are the
53 fibrous materials to be acted upon," that "so high a temperature is not absolutely necessary," and that he has "found, by experiment, that it is essential that a temperature equal to 70 pounds on the square inch should be employed," impose any specific upward limit to the degree of heat and pressure. It was urged that the statement that a pressure of 80 pounds was unnecessary, very clearly limited the patentee to that pressure; but we understand that the patentee simply states the fact that so high a pressure is not absolutely essential to a beneficial result, but that he prefers a pressure of 80 pounds or more to the square inch, and because, by the increased pressure, a better result could be produced, or a saving of time or alkali could be effected.

Nor do we consider the description of the Mellier process contained in the specification "confused, inconsistent, indefinite, ambiguous, or defective." It is sufficiently clear, precise, and intelligible; and, though a higher heat than that then used by the patentee, or a longer boiling than he recommends, may be requisite to produce the very best results in the use of the patented process, we are satisfied, from the proofs, that boiling straw, in accordance with that process, for the shortest time and at the lowest pressure indicated in the specification, will produce a useful

result—one better than that obtained in the same time and at the same cost by the use of the "open-tub process."

This brings us to the consideration of the question of novelty in respect to the process referred to in the second claim of the Mellier patent.

The Coupier and Mellier patent had introduced the practice of boiling straw and other fibrous materials, in a pure caustic alkali, (free from the presence of lime,) for the purpose of separating the coloring matter and associate constituents or proximates from the white fibre, or cellulose; and this process of Coupier and Mellier appears to have been, at the date of its introduction and until the subsequent discovery and invention of Mellier, the most advanced stage of the arts as applied to the purpose of manufacturing white paper from straw or other refractory material requiring the same material.

It is true that the rotary boiler of Spafford had been invented in 1840, and had been used before Mellier's invention in the manu-
54 facture of paper from other materials, and sometimes, perhaps, from straw, also for boiling stock, under a higher pressure than that used in the open-tub process; but we do not understand that Spafford invented or patented or supposed that he had invented any new process, but simply a form and construction of boiler, in which, by the turning of the boiler, the steam and the digesting liquid, whatever it might be, were effectually mingled with the charge or material to be heated, and in which the material heated was thus acted upon by the digesting liquid and heat in a more thorough and equable manner, and with greater economy of heat and time than when boiled in stationary open tubs or other stationary vessels. As we understand his specification and claim, no intimation is given that the digesting liquid should consist of a solution of pure caustic soda of any particular degree of strength; on the contrary, he speaks of the digesting liquid as a solution of potash, soda, or lime in water; nor do we understand that he indicated any particular degree of heat, or any pressure equal to 310° Fahrenheit, or had discovered or intended to intimate that a high degree of heat was useful or desirable. His only object was to produce, by the rotary movement of the vessel containing the charge and the digesting liquid, the complete intermingling of the two and the perfectly equable action of the digesting liquid upon every portion of the material heated.

There is certainly some testimony, though it is not of the most conclusive character, to show that rope and other refractory material had been boiled in rotaries at different pressures above seventy pounds prior to the invention of Mellier; but the liquid used for such boiling was not a solution of pure caustic alkali, but contained lime in considerable quantity; and the extraordinary degree of heat used was not regularly and uniformly attained and kept up, but was rather casual and incidental. We think the whole testimony shows that the parties directing or using this pressure had no knowledge of the utility of the particular process patented by Mellier, nor any conception of the advantages resulting from the use of pure caustic alkali and the high temperatures which he has recommended.

That paper-makers and bleachers had, at the date of Mellier's
55 invention, a general knowledge that the boiling of the material to be bleached, or prepared for bleaching, in an alkaline solution gave efficiency to the action of the alkali upon such material is certain; but the full and accurate knowledge of the state of the art before possessed by Messrs. Hays and Wells, the defendants' experts, and the long continued experiments of the one aided by the advice of the other,

for the purpose of discovering an economical and satisfactory mode or process of making white paper from straw and other similar materials, did not enable them to reach that result or lead them to adopt the process described in Mellier's patent. They abandoned their experiments. They failed to produce white paper from straw with such economy of such quality and price that its manufacture and sale would give profitable employment to the labor and capital required for that purpose; and neither they nor any of the several manufacturers of paper who have been examined as witnesses in this case were aware of the benefits to be derived from the use of that extreme heat during the boiling process which Mellier's process requires. The Coupier and Mellier process was introduced into this country in 1853; and although the invention of Spafford of the rotary boiler for boiling rags in 1840, and its subsequent use had furnished the limit and the means for boiling at much higher temperatures than could be obtained in open vessels, neither the defendants' expert in his experiments nor the manufacturers or the workmen in the paper-mills of the country ever attempted to use the extraordinary heat now used, or the useful process invented and patented by Mellier. Spafford's rotary had been in use over fifteen years, the Coupier and Mellier process had been in use more than three years, but the Mellier process was nowhere known or in use in the manufacture of white paper from straw until after its invention was made known to Buchanan and Palser, and probably Howland, late in 1856. Until the defendants, in 1857, entered upon its use, the open-tub process of Coupier and Mellier was still in general use when white paper was attempted to be manufactured from straw, and it was not until the French patent of Mellier was exhibited that this process was known in this country. The defendants commenced the manufacture of straw-paper in 1857,
56 and on the 22d November, 1859, they obtained a patent for an improvement in the manufacture of paper-pulp, and in their specification they described a process of boiling straw in which they say they employ 60 gallons of caustic alkali, of a strength indicating $3\frac{1}{2}°$ to $3\frac{3}{4}°$ of Baumé to every 100 pounds of straw in a rotary steam-boiler, and raise the pressure by fire below the boiler to 100 to 130 pounds and maintain that pressure for four hours.

To Mellier, p. 62. 2° to 3° Da.

In this specification they say: "A well-known method, patented by letters-patent No. 17387, the same under which plaintiff claims," of reducing straw to pulp is to employ a solution of caustic alkali of a strength indicating 2° to 3° Baumé, 70 gallons of the solution to 100 pounds of the cut straw, the whole thing placed in a boiler and boiled under a pressure of not less than 84 pounds for about three hours; but we find in practice that the above method does not sufficiently disintegrate the straw, nor does it sufficiently dissolve or remove the woody, aluminous and silicious matters from the fibrous portions, &c. And again, "On comparison of the pulp produced from straw by our , and *and* that made after the mode described in the patent before mentioned, a very marked difference in appearance is observable in favor of our invention. The paper made from the pulp above mentioned also presents the same striking difference in favor of our improvement."

This specification seems to show that they had been using the process of Mellier; for it is almost certain, upon the proofs in this case, that in that way alone could they have made the discovery and comparison referred to. The specification says, "We find in practice," &c., an allegation somewhat inconsistent with some of the allegations of the defendants' answer and of some of the positions maintained by their counsel on the argument.

Upon the whole evidence in the case, we think there is scarcely any reason to doubt that the process now used by the defendants was founded upon the Mellier patent, and the knowledge of the process which they obtained from Buchanan, as shown by the testimony of Godard, of Parks, and of Beaumont; and that the process now used by the defendants is an infringement of the patent held by the plaintiff.

57 It is insisted that the defendants do not use the Mellier process, and various grounds are taken upon which to maintain this position.

It is said that Mellier steeps the straw in warm water and the defendants do not; and that Mellier uses steam-heat exclusively, while the defendants use fire-heat, almost exclusively. The answer to these allegations is that the steeping in warm water is no part of the process patented, and that under the second claim of the Mellier patent it is immaterial whether the boiling is produced by steam-heat or fire-heat.

It is further insisted that *Miller* separates the alkali from the steam-heat to prevent its being diluted, while the defendants admit to the solution all the steam they use; and that Mellier uses 70 gallons of the alkaline solution, from 2° to 3° Baumé, while defendants use 60 or 65 gallons at 3½° to 3⅜° to each 100 pounds of straw. The answer to this argument is, that, under the second claim of the Mellier patent, the admission or exclusion of the heated steam, as stated, is immaterial, and that the evidence satisfactorily shows that, by the admission of the steam into the rotary of the defendants, the quantity of alkaline solution used by them is increased and its strength diminished until it becomes both in strength and quantity substantially like, if not identical with, that which plaintiff's patent states is to be employed in the process of Mellier.

It is also insisted that Mellier's specification states that he boils at 70 pounds' pressure, and regards a higher pressure as unnecessary, except for saving alkali, while defendants boil at 130 pounds' pressure to improve the product; and that Mellier boils about three hours, though a much longer boiling is necessary to produce a fair result, provided the strength of alkali and degree of pressure are no greater than he recommends, while the defendants' boil four hours. The patent of Mellier, it has been seen, does not limit him to a pressure of 70 lbs. or of 84 lbs., and if the boiling for three hours produces a beneficial result, such as the patent indicates, the defendants can hardly escape the consequences of infringement by continuing the boiling for an hour afterwards, in order to produce a better result. Even if it be true, as claimed,

58 that a longer boiling and greater pressure produce better results than can be produced by boiling only three hours with a pressure of 70 lbs., or even of 84 lbs., we see no reason for holding that there is no infringement of the Mellier patent, when the boiling, which he recommends should continue about three hours, (although this time is not specifically mentioned in the claim,) is continued for an hour longer than he recommends.

In short, we think that the patent of Mellier is valid; that he is the original and first inventor of the process claimed therein; that his invention is useful; and that the process used at the mills owned and operated by the company, in which the plaintiff is a member, and at the mills of the defendants, is, in substance, Mellier's process, as claimed in the second claim of his patent; and that the plaintiff is entitled to a permanent injunction and an account, as prayed for in his bill.

In reaching this result, we have not failed to consider the defendants patents and their effect. Their patent of November, 1859, referred to in the plaintiff's bill, by the terms of its specification, expressly excludes from its scope and operation the process described in the plaintiff's patent, and it was probably granted by the Patent-Office, on the ground that the claim made, taken in connection with such disclaimer, did not conflict with the claims of the Mellier patent. This conclusion was probably based upon the facts that the strength of solution in Mellier's was from 2° to 3° Baumé, and its quantity about 70 gallons to the 100 pounds of stock, while that in the defendants' process was to be from $3\frac{1}{2}$° to $3\frac{3}{4}$° Baumé, and its quantity 60 gallons to the same quantity of stock; and that a higher degree of heat was never needed—differences which were probably considered sufficient to make two processes substantially different.

In considering the process of this patent in connection with the Mellier process, and the defendants' present practice, it is to be remembered that the specification directs that this stronger solution be placed in a boiler and heated entirely by a fire applied below it, and without any introduction and condensation of steam from any other boiler to increase the quantity and diminish the strength of the alkaline solu-
59 tion used, as has been since practiced by the defendants. The specification of Mellier also recommended a construction of the boiler which prevented any increase of quantity or diminution of strength in the use of his process; and this was desirable if the weaker solution of alkali recommended by him was to be used. The proof shows that by the introduction and condensation of steam from another boiler, the alkaline solution in defendants' rotary is increased about twenty per cent. in quantity, while its strength is consequently diminished until it is not beyond 3° Baumé; thus making the quantity of strength substantially that required by the Mellier process, and the strength much less than that recommended in the defendants' patent of 1859. This shows that the defendants do not now in fact use only sixty gallons of the alkaline liquid to the 100 pounds of stock, or use that at the higher strength required by their first patent, and, doubtless, for the reason that their present process (in substance the Mellier process) gives a better result.

The patent to the defendants granted March 20th, 1860, we regard as, in substance, a patent for the staple fibre produced by the process patented in November, 1859, and as standing or falling with that patent.

The patent of the 3d of July, 1860, describes at great length an ingenious and useful apparatus, and the particular mode or process adopted in their use for the purposes indicated. This patent does not claim the apparatus described, (although if it was invented by the defendants, or either of them, it is probably covered by some other patent,) and the specification is not of such a character as to suggest that the claim was in conflict with that of the Mellier patent. The entire process described embraces the use of apparatus entirely different from that particularly specified in the Mellier patent, and the claim in this patent was more likely to be allowed without the consideration of the Mellier patent than the claim of the patent of November, 1859, above referred to.

It is not shown that the question of interference, in respect to these patents of the defendants and the Mellier patent, was even considered by the Patent-Office, and if it was, there is no proof that the facts shown in this case were then presented. Our judgment is, that these
60 patents of the defendants ought not to prevent a decree for the plaintiff in this suit.

There will be a decree for a permanent injunction, and an account, substantially as prayed for in the plaintiff's bill.

March 23, 1863.

Schedule referred to in letters-patent of the United States to Charles Mellier, dated May 26, 1857.

Be it known that I, Marie Amédeé, of Paris, in the Empire of France, have made an invention for an improvement in the manufacture of paper, and I do hereby declare that the following is a full and exact description:

The invention has for its object a peculiar process for the treating of straw and other vegetable fibrous materials requiring like treatment, preparatory to the use of such fibres in the manufacture of paper; and the improvement consists in subjecting straw, or such other fibrous materials, to a pressure of at least seventy pounds on the square inch when boiling such fibrous matters in a solution of caustic alkali.

For this purpose the straw or fibrous matters are cut into short lengths, soaked in warm water, and washed. They are then placed in a suitable boiler—and I use for such purpose a rotary-boiler, provided with a coil or coils of steam pipe for the purpose of heating the contents; and I prefer that the boiling should be carried on at a temperature to produce at or about 80 lbs. on the square inch, in the boiler where are the fibrous materials to be acted upon. But so high a temperature is not absolutely necessary; for I have found, by experiment, that it is essential that a temperature equivalent to seventy pounds on the square inch must be employed. The quantity of alkali used is at the rate of about 16 per cent. of caustic soda or potash, of the
61 straw or fibrous substance under process. The fibres may then be bleached by the use of a comparatively small quantity of bleaching powder or chloride of lime.

To enable others skilled in the art to make and use my invention, I will proceed to deseribe more fully the manner of using the same.

The straw or other fibrous materials requiring a like process to prepare the same for the paper-manufacturing is first, as heretofore, to be cut in a chaff-cutting or other machine into short lengths, and to be freed from knots, dirt, or dust, and then steeped for a few hours in hot water. The straw or fibrous materials and a weak solution of caustic alkali are then to be placed in a suitable close boiler, heated by steam as hereafter explained, and the heat is to be raised to such a degree as to attain and maintain for a time a pressure internally of the boiler equal to or exceeding seventy pounds on the square inch, that is, about 310 degrees of Fahrenheit; by which means a considerable saving of alkali, as well as time and fuel, results, as compared with the means of using a hot solution of caustic alkali, as now practiced in preparing straw and other fibres for paper-makers.

The boiler employed for the purpose, and the manner of heating it by steam, may be varied, but, first, it must have a rotary motion either on its long or on its small axis, by means which are very well known; and, secondly, I prefer not to send the steam directly into the liquid in which the materials are immersed, but to pass it either in a jacket around the boiler, or through a coil or system of steam-pipes inside of it, so that the steam does not mix with the caustic alkaline solution in the middle portion of the boiler, but is kept separate, and does not, therefore, in condensing, dilute the caustic alkaline solution used.

The plan of construction of the boiler I would recommend would be,

if the boiler is to rotate vertically or on its small axis, as very well known, to cover it with a jacket, so that the steam could circulate from one end to the other between the two plates, or, rather, if it is to revolve horizontally or upon its long axis, as is equally very well known, to fix near each end of the boiler, and inside of it, a diaphragm or partition;
62 which partitions are connected together by numerous tubes, which are arranged in a circle near the outer circumference of each partition.

By this arrangement the steam is introduced through the hollow axis at one end of the boiler, and it passes through the steam-pipes, and thence into the compartment at the other end of the boiler, where it and the condensed steam are conveyed away, as is understood, through the other hollow axis. In adopting the plans of not sending directly the steam into the boiler, I found the three following advantages:

1st. Not to dilute, as I have already said, the alkaline solution.

2d. To avoid the trouble of having sometimes the end of the steam-pipe in the boiler choked with straw, and to prevent, in case that by one cause or another the pressure in the steam-boiler would fall under the degrees of the pressure in the straw-boiler, the pressing of the first by the second, viz., the absorption of straw and alkaline solution from the straw-boiler into the steam-boiler.

3d. The greatest facility for cooling the straw-boiler when the pressure has been maintained for a sufficient length of time, by means of turning off the steam at one end, letting it at the other end out of the jacket, or of the coils or steam-pipes just described, and passing through the same a stream of cold water, which, at the same time that it cools the mass, furnishes a quantity of warm water, which can be received in convenient vessels, and will be found very useful for washing the straw or other fibrous materials after boiling.

By means of submitting the straw or similar fibrous materials to the pressure of between 70 and 84 pounds on the square inch inside of the boiler, I can reduce considerably the proportion of alkali; and the solution which I prefer to use is to be from two to three degrees of Baumé, or of a specific gravity of from 1.013 to 1.020, and at the rate of about 70 gallons of such solution to each cwt. of straw or other fibrous vegetable matter requiring like treatment.

63 The boiler is to be filled with straw and alkaline solution, and then closed fluid and steam tight.

The boiler is made to revolve slowly, say about one or two revolutions per minute, and the steam is to be admitted. I find it desirable to keep up the heat and pressure during about three hours after the pressure above mentioned has been obtained, when the process of boiling is complete. A steam-gauge properly fixed upon the boiler will enable one to ascertain when the pressure has attained the required degree.

When the apparatus and the fibres under process have been cooled by the means hereinbefore mentioned, or rather when the pressure has been reduced to nothing, I open the man-hole of the boiler, empty the materials in suitable vessels, and wash them, first with hot water, then with cold water, until the liquor runs perfectly clear. I then steep the fibres for about an hour in hot water acidulated with a quantity of sulphuric acid equal to about two per cent. of the weight of the fibres under process, and finally the washing is completed with cold water.

The straw or fibre may then be bleached in the ordinary manner, and it will be found to be accomplished by a comparatively small quantity of chloride of lime.

Having thus described the nature of my said invention and the man-

ner of performing the same, I would have it understood that I do not claim the general use of caustic alkaline solution, nor the employment generally of a close boiler for boiling straw or other vegetable fibrous substances.

But what I claim as my invention, and desire to secure by letters-patent, is the use of a solution of caustic soda, (Na°,) in a compartment of a rotary vessel, separate from that which contains the steam-heat, substantially as described.

I also claim the within-described process for bleaching straw, consisting in boiling it in a solution of pure caustic soda, (Na°,) from 2 to 3 degrees Baumé, at a temperature of not less than 310 degrees Fahrenheit, after it has been soaked and cleansed, and before submitting it to the action of a solution of chloride of lime, from 1 to 1½ degrees, substantially as described.

64 *Decree.*

At a special term of the circuit court of the United States of America for the northern district of New York, in the second circuit, held at the clerk's office, in Utica, on Wednesday, the 25th day of March, in the year of our Lord one thousand eight hundred and sixty-three.

Present, the Honorable Nathan K. Hall, judge.

COE S. BUCHANAN
vs.
GARDNER HOWLAND AND JOSEPH B. PALSER. } In equity.

This cause having been duly noticed for argument at the last stated term of this court, and the same having been heretofore brought on for argument on pleadings and proofs, and fully argued by Messrs. Tiffany and Keller for the plaintiff, and Messrs. Gale and Beach for the defendants, and due deliberation thereon had, it is now ordered, adjudged, determined, and decreed, and this court, by virtue of the power and authority therein vested, doth order, adjudge, determine, and decree that the patent referred to in plaintiff's bill, granted by the United States to Marie Amédeé Charles Mellier, of Paris, France, for an improvement in making paper-pulp, and bearing date the 20th day of May, 1857, is a good and valid patent; that the said Mellier was the first and original inventor of the process or processes thereby patented; that the said plaintiff, at the time of the commencement of this suit, was the assignee and legal owner of such patent, as alleged and set forth in said plaintiff's bill in this suit; that the said defendants, and each of them, have used the process claimed in the second claim of the said patent without an existing license or legal authority therefor, and have thereby violated and infringed the exclusive rights secured to the said Mel-
65 lier by the patent aforesaid, and held and owned by the said plaintiff as the assignee and owner thereof; and that said plaintiff is entitled to a permanent injunction, and an account of the use of such inventions, and of the gains and profits of such use made by the said defendants, and each of them, and to a decree of this court for the payment of such profits and gains, and of the plaintiff's costs in this suit by the said defendants to the said plaintiff.

And this court doth further order, adjudge, determine, and decree that it be referred to Augustus A. Boyce, esq., of Utica, one of the masters of this court, to take and state an account of such use, gains, and profits, and to report the same to this court with all convenient speed,

and that, on the coming in and confirmation of his report, the said defendants pay to the said plaintiff the amount of such gains and profits so reported, and, also, his (the said plaintiff's) costs in this suit, to be taxed, and that the said plaintiff have execution therefor.

And this court doth further order, adjudge, determine, and decree that a permanent injunction issue out of and under the seal of this court, directed to the said defendants, their servants and workmen, restraining them and each of them from the further violation or infringement, in any part or in any manner whatsoever, of the said letters-patent of the United States, so granted to the said Mellier, and dated the 26th day of May, 1857, and so assigned to the said plaintiff, and especially from the use of the process and mode of operation particularly described in the specification annexed to said letters and embraced in the second claim contained in such specification.

And all other questions are reserved until the coming in and confirmation of the said master's report.

N. K. HALL.

66 *Order staying injunction.*

At a special term of the circuit court of the United States of America for the northern district of New York, in the second circuit, held at the clerk's office, in Utica, on Saturday, the 25th day of April, in the year of our Lord one thousand eight hundred and sixty-three.

Present, the Honorable Nathan K. Hall, judge.

COE S. BUCHANAN
vs.
GARDNER HOWLAND AND JOSEPH B. PALSER. } In equity.

On reading and filing affidavits and notice of motion for a stay of injunction in this cause, and also affidavits in opposition thereto, and after hearing Mr. John B. Gale, of counsel for the defendants, and Mr. J. Tiffany, of counsel for the plaintiff, it is hereby ordered that the injunction heretofore issued in this cause (and stayed and suspended by an order of one of the judges of this court to allow this motion to be heard) be further stayed and suspended until the further order of this court, or until the hearing and decision of this cause upon the appeal heretofore taken therein, in case such appeal shall be held to be well and properly taken from the decree heretofore made by this court in this cause; or if said appeal shall be held by the Supreme Court of the United States to have been prematurely taken, then that such injunction be stayed and suspended until the expiration of twenty days after the report of the master or commissioner under the order of reference directed by the decree of this court in this cause shall be confirmed by the order or decree of this court, or under the general rules and practice of this court in equity cases; and if another and proper appeal to the Supreme
67 Court of the United States shall then be taken to the final decree in this cause within ten days after the said master's or commissioner's report shall stand or be confirmed, then that said injunction shall be stayed and suspended until ten days after the decision of the said Supreme Court on the said appeal: provided that this order shall be void and of no effect, unless the defendants, within twenty days after the entry of this order, shall file with the clerk of this court their bond in the penalty of ten thousand dollars, with two sufficient sureties, who shall make affidavit that they are respectively worth the sum of ten

thousand dollars each over and above all their debts and liabilities, conditioned to pay to said plaintiff all damages which he may sustain or in any way suffer or be entitled to by reason of any infringement of the patent under which the plaintiff prosecutes in this suit, or of his rights as finally determined and established in this cause; and, also, unless the defendants shall, within the twenty days next preceding the expiration of every period of four months after the entry of this order, file a new bond, bearing date within said twenty days, with like penalty, sureties and conditions. And the said plaintiff is to be at liberty to apply to this court, or any judge thereof, in vacation, for a modification or discharge of this order, or for further or better security, if he shall deem it expedient to do so.

N. K. HALL.

U. S. OF AMERICA,
Northern District of New York:

I, Augustus A. Boyce, clerk of the circuit court of the United States, in and for the northern district of New York, do hereby certify that the foregoing is a true and correct copy of an order as entered in my office, this 25th day of April, A. D. 1863.

In testimony whereof I have hereunto affixed the seal of this court, and have hereunto subscribed my name, this above-mentioned date.

[L. S.] A. A. BOYCE, *Clerk.*

68 EXHIBIT "I."

Know all men by these presents, that I, Coe S. Buchanan, of the city, county, and State of New York, in consideration of the sum of one dollar and other valuable considerations received, to my full satisfaction of Benjamin Buffum, of the city and county of Providence, State of Rhode Island, trustee for the American Wood-Paper Company, do hereby bargain, sell, assign, transfer, and convey unto said Benjamin Buffum, trustee as aforesaid, and to said American Wood-Paper Company, their successors and assigns, all my right, title, and interest in and to letters-patent of the United States, originally granted to Marie Amédeé Charles Mellier, of Paris, dated May 26th, A. D. 1857, ante-dated August 7th, A. D. 1854, by said Mellier assigned to me through Victor Beaumont, his attorney, on the 19th day of June, A. D. 1857, which letters-patent are entitled, "for improvement in the manufacture of paper-pulp," my said right, title, and interest in said original letters-patent, and in and to the invention therein described, being the entire title therein and thereto: To have and to hold the said original letters-patent to the said Benjamin Buffum, trustee as aforesaid, and to said American Wood-Paper Company, their successors and assigns, with all rights and privileges incident thereto or growing out of the same, and all claims for damages or profits against all infringers of said letters-patent for and during the period from the date of said letters-patent till the expiration of the term for which said letters-patent were originally granted, and for such other terms or periods as said letters-patent may be renewed or extended. And for the considerations aforesaid, I do hereby covenant with the said Benjamin Buffum, trustee as aforesaid, and with the said American Wood-Paper Company, their successors and assigns, that, at the proper time, the personal representatives of the said Marie Amédeé Charles Mellier will apply to the Commissioner of Patents of the United States for an extension of said letters-
69 patent as issued, and that they will prepare, as required by law

of applicants for extension of letters-patent, the accounts and all other statements, and papers necessary for obtaining the same, and that they shall and will do everything necessary and proper for securing the success of such application; and that if such extension shall be obtained, that they and myself will immediately thereupon transfer and assign said extended patent to the said American Wood-Paper Company, their successors and assigns, without further consideration, it being understood that said company shall pay all necessary expenses of procuring such extension, at the Patent-Office, after proper application therefor, and accounts properly verified shall have been placed in the hands of the proper officers of said company; and I do further covenant with said Buffum, trustee as aforesaid, and with said American Wood-Paper Company, their successors and assigns, that I will give my personal services for a reasonable compensation in all matters relating to the sustaining the validity of said letters-patent as issued. And for myself, and on behalf of the said patentee, and his legal and personal representatives as aforesaid, under the power and authority as aforesaid, I do hereby constitute and appoint the said Benjamin Buffum, trustee as aforesaid, and the said American Wood-Paper Company, their successors and assigns, the true and lawful attorney and attorneys of the said Marie Amédeé Charles Mellier, and of his legal and personal representatives, and of myself, as his assignee, to claim, demand, sue for, and recover to their use, any and all damages or profits to which they the said patentees, or their legal and personal representatives, or myself, may be entitled for infringements of said letters-patent, the same being done without expense to me.

Provided, however, that all damages or profits which may be recovered for infringements prior to the date of this conveyance shall be accounted for and paid over to me the said Buchanan, upon my paying my pro rata share of the expenses of the litigation in which the same may be recovered; and in case any settlement shall be made by said company for such past damages and profits without litigation, it shall be made with the assent of me, the said Buchanan; and if not satis-
70 factory to me, I reserve the privilege of prosecuting said claims for my own benefit, at my own expense.

In testimony whereof I have hereunto set my hand and seal, this 14th day of October, A. D. 1863.

C. S. BUCHANAN. [L. S.]

Executed and delivered in presence of—
FRED. S. VANDERPOOL.
F. R. TAYLOR.

U. S. PATENT-OFFICE.

Received and recorded October 23d, 1863, in liber D 7, page 118, of transfers of patents.

In testimony whereof I have caused the seal of the Patent-Office to be hereunto affixed.

D. P. HOLLOWAY,
Comm'r of Patents.

71 EXHIBIT "K."

Whereas Coe S. Buchanan, of the city, county and State of New York, by instrument in writing, bearing date the fourteenth day of October, A. D. eighteen hundred and sixty three, conveyed to Benjamin Buffum,

of the city and county of Providence, State of Rhode Island, as trustee for the American Wood-Paper Company, all his right, title, and interest, in and to letters-patent of the United States originally granted to Marie Amédeé Charles Mellier, of Paris, dated May 26th, A. D. 1857, antedated August 7th, A. D. 1854, by said Mellier assigned to him, through Victor Beaumont, his attorney, on the 19th day of June, A. D. 1857, which letters-patent are entitled, "For improvement in the manufacture of paper-pulp," his said right, title, and interest in said original letters-patent, and in and to the invention therein described, being the entire title therein and thereto:

Now, therefore, I, the said Benjamin Buffum, in consideration of one dollar, and other valuable considerations received, to my full satisfaction, from said American Wood-Paper Company, a corporation created by the general assembly of the State of Rhode Island, do hereby transfer, and convey unto said corporation, their successors and assigns, all the right, title, and interest in said letters-patent, and in the invention therein described, conveyed to me, as trustee, by the instrument aforesaid, and I do hereby substitute the aforesaid American Wood-Paper Company, their successors and assigns, to all powers, rights, and privileges granted to me by the instrument aforesaid, and secured to me by the covenants therein contained and set forth.

In testimony whereof I have hereunto set my hand and seal, this sixteenth day of June, A. D. eighteen hundred and sixty-five.

(Signed) BENJAMIN BUFFUM.

Executed and delivered in presence of—
ALFRED K. HALL.
ALFRED R. KING.

72

73 EXHIBIT "L'."—No. 25418.

The United States of America to all to whom these letters-patent shall come:

Whereas Morris L. Keen, of Roger's Ford, Pennsylvania, has alleged that he has invented a new and useful improvement in boilers for making paper-pulp from wood, which he states has not been known or used before his application; has made oath that he is a citizen of the United States; that he does verily believe that he is the original and first inventor or discoverer of the said improvement; and that the same hath not, to the best of his knowledge and belief, been previously known or used; has paid in to the Treasury of the United States the sum of two dollars, and presented a petition to the Commissioner of Patents, signifying a desire of obtaining an exclusive property in the said improvement, and praying that a patent may be granted for that purpose:

These are therefore to grant, according to law, to the said Morris L. Kean, his heirs, administrators, or assigns, for the term of fourteen years from the thirteenth day of September, one thousand eight hundred and fifty-nine, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said improvement, a description whereof is given in the words of the said Morris L. Keen, in the schedule hereunto annexed and is made a part of these presents.

In testimony whereof I have caused these letters to be made patent and the seal of the Patent-Office has been hereunto affixed.

Given under my hand, at the city of Washington, this thirteenth day of September, in the year of our Lord one thousand eight hundred and fifty-nine, and of the Independence of the United States of America the eighty-fourth.

(Signed) JACOB THOMPSON,
Secretary of the Interior.

Countersigned and sealed with the seal of the Patent-Office.

(Signed) S. T. SHUGERT,
Acting Commissioner of Patents.

(Here follows diagram, marked page 73.)

74 The schedule referred to in these letters-patent and making part of the same.

To all whom it may concern:

Be it known that I, Morris L. Keen, of Roger's Ford, in the county of Montgomery, and State of Pennsylvania, have invented certain new and useful improvements in boilers for boiling wood or ligneous materials for making paper-pulp, under pressure, and I do hereby declare that the following is a full, clear, and exact description of the construction and operation of the same, reference being had to the accompanying drawings in which—

Fig. 1 represents a perspective view of said boiler.

Fig. 2 represents a vertical central section through the same.

My invention relates to the construction of a boiler for boiling wood and ligneous materials for making paper-pulp, in which proper provision is made for keeping the stock covered by the alkali or liquid used, and giving it motion to insure the mass being properly boiled throughout, and a discharge valve or cock, by means of which the stock when sufficiently boiled, is blown out in a pulpy state.

To enable others skilled in the art to make and use my invention, I will proceed to describe its construction and operation.

A represents a vertical cylindrical boiler, which is mounted on supports B, or on any other suitable frame. The upper part of the boiler is made conical and is provided with an expansion-chamber, C, through the aperture of which the boiler is charged, and which is closed by a cover, D, which is bolted steam-tight to the same. The bottom of the boiler A, is made funnel-shaped, and ends in the centre in the discharge-pipe E, which is closed by a piston or stop-cock, G. The latter is secured to the rod H, and can be opened or closed by means of the hand-wheel F, of the rod H, which passes through the stuffing-box I, and has its lower bearing on the bracket *a*. K represents two stirrers, the shafts of which run at their lower ends in the steps *b*, while their upper ends pass through the stuffing-boxes L, and are provided with pinions M,
which are driven by suitable gearing. The shafts of the stirrers
75 K, are provided on one side only with the horizontal stirring arms, which, when the boiler is to be charged are turned towards the periphery of the boiler, and are therefore not in the way of the material as it is thrown into the boiler. *d* represents a perforated plate, which is secured to the rod N, and which rests on the brackets *g*, of the expansion-chamber C. It is intended to press the material down and to keep it submerged in the fluid in which it is to be boiled. The plate *d*, is prevented from rising by the upper end of the rod N, being in contact

license herein granted for the purposes aforesaid. And I do hereby further covenant and agree with said Buffum, trustee as aforesaid, and with said American Wood-Paper Company, their successors and assigns, that I will make conveyance to him or them of an absolute and exclusive license to use any and all improvements which I have made or which I may hereafter make upon my said patented invention, to be used for the purposes aforesaid, throughout the United States of America, for the full term for which any letters-patent for any such improvement may be granted. And I do further hereby covenant
77 and agree with said Buffum, trustee as aforesaid, and with said American Wood-Paper Company, their successors and assigns, that I will make application in due time under the law for an extension of said letters-patent, and use all proper and lawful means and diligence for procuring the same for the benefit of said company, such application and the proceedings necessary to secure such extension being conducted at their expense. And I do hereby constitute and appoint the said Buffum, trustee as aforesaid, and the said American Wood-Paper Company, their successors and assigns, my true and lawful attorney and attorneys irrevocable, to claim, demand, sue for, and recover, to his and their use, any and all claims for damages and profits arising from the infringement of my patented inventions, for which I have herein granted, and may hereafter grant, licenses for the exclusive use as aforesaid to him or them, such claim being prosecuted without expense to me; and to use my name in any and all suits or proceedings in which it may be necessary to use the same for the protection of the rights herein granted and covenanted to be granted. And I do further covenant with said parties that I will execute any other instrument or instruments for the further assurance of the title hereby granted that may be required to perfect the same, and secure to said parties all the remedies which they may have in law and equity for the protection of their rights.

In testimony whereof I have hereunto set my hand and seal this the eighteenth day of May, A. D. eighteen hundred and sixty-three.

(Signed) MORRIS L. KEEN.

Executed and delivered in presence of—
JOHN FARRELL.
WM GOODWIN.

U. S. PATENT-OFFICE.

Received and recorded Oct. 23, 1863, in liber D 7, page 111, of transfers of patents.

In testimony whereof I have caused the seal of the Patent-Office to be hereunto affixed.

D. P. HOLLOWAY,
Comm'r of Patents.

78 EXHIBIT "N1."—No. 38901.

The United States of America to all to whom these letters-patent shall shall come:

Whereas Morris L. Keen, of Roger's Ford, Pennsylvania, has alleged that he has invented a new and useful improved boiler for making paper-pulp, which he states has not been known or used before his application; has made oath that he is a citizen of the United States; that he

with the lower face of the cover D. O represents try-cocks, by which the material in the boiler can be tried, to what degree of perfection the stock is worked.

The operation is as follows:

The boiler being charged with the proper solution of caustic alkali or other suitable fluid, and with the material which is to be reduced to pulp, the plate *d* is placed upon it, and the cover G is screwed down tightly. The boiler A is then heated, either by a direct fire or by any other heating apparatus, and the mass in the boiler is boiled and stirred until thoroughly disintegrated. During this process the steam arising from the fluid rises through the perforated plate *d*, and fills the expansion-chamber C, whence it exerts a pressure upon the boiling mass in the boiler.

When the stock has been reduced to the desired perfection, the stop-cock G is opened by means of the hand-wheel E, and the entire mass is blown by the pressure of the steam in the expansion-chamber and boiler through the pipe E, as a pulp, into an open tank adjacent to the boiler A. The expansion-chamber C may be provided with a pipe leading to a steam-gauge, to indicate the pressure of steam in the boiler.

Having thus described my invention, what I claim is a boiler for boiling, under pressure, wood and ligneous materials for making paper-pulp, constructed with an expansion-chamber, stirrers, and discharge valve or cock, arranged for the purposes and in the manner substantially as herein stated.

(Signed) MORRIS L. KEEN.

Witnesses:
EPHRAIM MILLER.
HUGH BURGESS.

76 EXHIBIT "M[1]."

Know all men by these presents that I, Morris L. Keen, of Roger's Ford, Montgomery County, and State of Pennsylvania, in consideration of the sum of one dollar and other valuable considerations received to my full satisfaction of Benjamin Buffum, of the city and county of Providence, and State of Rhode Island, trustee for the American Wood-Paper Company, do hereby grant, bargain, and sell to said Buffum, trustee as aforesaid, an absolute and exclusive license to use my invention in boilers for making paper-pulp from wood, for which letters-patent of the United States were granted to me on the thirteenth day of December, A. D. 1859, in the manufacture of paper-pulp as aforesaid, within and throughout the United States of America, for the full term for which said letters-patent are granted, and during any extension or renewal thereof: To have and to hold the same to him, the said Buffum, for the benefit of said Wood-Paper Company, and to said company, their successors and assigns, for and during the period or periods aforesaid. And I do hereby covenant with said Buffum, trustee as aforesaid, and with said American Wood-Paper Company, their successors and assigns, that I have heretofore made no conveyance, grant, assignment, or license of my said patent, or any interest in the same, or right to use my said invention, which will interfere with this grant of an exclusive license for the purposes aforesaid, or which will impair the value of the same; and also that I will hereafter make no grant, conveyance, assignment, or license, of or under said patent, or of the right to use said invention which will conflict with or impair the value of the exclusive

does verily believe that he is the original discoverer of the said invention; and that the same hath not, to the best of his knowledge and belief, been previously known or used; has paid into the Treasury of the United States the sum of thirty-five dollars, and presented a petition to the Commissioner of Patents signifying a desire of obtaining an exclusive property in the said invention, and praying that a patent may be granted for that purpose:

These are therefore to grant, according to law, to the said Morris L. Keen, his heirs, administrators, or assigns, for the term of seventeen years from the sixteenth day of June, one thousand eight hundred and sixty-three, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said invention, a description whereof is given in the words of the said Morris L. Keen in the schedule hereunto annexed, and is made a part of these presents.

In testimony whereof I have caused these letters to be made patent, and the seal of the Patent-Office has been hereunto affixed.

Given under my hand, at the city of Washington, this sixteenth day of June, in the year of our Lord one thousand eight hundred and sixty-three, and of the Independence of the United States of America the eighty-seventh.

(Signed) W. J. OTTO,
Acting Secretary of the Interior.

Countersigned and sealed with the seal of the Patent-Office.

(Signed) D. P. HOLLOWAY,
Commissioner of Patents.

(Here follows diagram, marked page 78.)

79 The schedule referred to in these letters-patent and making part of the same.

To all whom it may concern:

Be it known that I, Morris L. Keen, of Roger's Ford, in the county of Montgomery and State of Pennsylvania, have invented certain new and useful improvements in boilers for making paper-pulp; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings making a part of the specification, and which represent the boiler in elevation, with a portion of its upper part represented in section, to show the interior arrangement thereof.

In boilers, where a perforated diaphragm is placed in the interior, and through which diaphragm the material out of which the pulp is to be made is to be charged into the cylinder, it is found that the material falling upon the diaphragm chokes up its openings; and, moreover, gets above or on top of the liquid, which it is the special object of the diaphragm to prevent. My object and purpose is to prevent this difficulty; and I have achieved it in a very simple manner. My invention consists in connecting the man or feed hole in the shell of the boiler with the man or feed hole through the diaphragm, by a perforated well or cylinder, so that the material can be charged through said well into the boiler without falling upon or clogging the perforated diaphragm.

To enable others skilled in the art to make and use my invention, I will proceed to describe the same, by reference to the drawings.

A represents a boiler, which stands vertically in the furnace or brick work, and which, for strength and convenience, has hemispherical ends

its body being cylindrical. This boiler is suspended to the brick work or foundation, by flanges *e*, so that it may expand or contract without loosening itself from the foundation or its support.

In the interior of the boiler, near its upper end, there is placed a perforated diaphragm, B, through the centre of which there is an opening, *c c*, and at the top or crown of the boiler there is also a man or
80 feed-hole, or opening, *a a*, and these two openings, *a c*, are connected by a perforated well or cylinder, G, to act as a guide for the material being charged into the boiler, and to prevent it from falling upon the perforated diaphragm, and thus not only choking its openings, but getting on top of the liquid, which it is important to avoid as damaging to the pulp.

The openings, *a c*, are respectively closed after the boiler is charged, by the covers *b d*, which may be secured in any of the known ways of securing man-hole covers in steam boilers. Above the perforated diaphragm B, there is an expansion-chamber, I, into which the liquid contents of the boiler expand when the fire is applied to the boiler, whilst the perforated diaphragm B, keeps the crude material always submerged.

E is a discharge-pipe at the bottom of the boiler A; and F a stop or discharge valve, for blowing out the contents of the boiler whilst under pressure, when said contents have been sufficiently boiled.

C is a steam-indicator, and D a safety-valve, of any of the common constructions; and instead of their being placed at the top of the boiler, they may be brought down to any convenient position or locality, near the attendant, so as to be readily observed by him.

The boiler may be heated by the direct application of fire, or by any other convenient or known mode; but I prefer to use a direct application of heat, and, for this purpose, use a fire car or truck, H, on wheels, which is withdrawn when the boiler is to be discharged, and replaced immediately after the boiler is again refilled for service.

Having thus fully described the nature, object, and purpose of my invention, what I claim therein as new, and desire to secure by letters-patent, is, first, a boiler provided with a perforated diaphragm and well, or their substantial equivalents, arranged in the manner and for the purpose described.

I also claim, in combination with the boiler, the arrangement of the discharge pipe and valve, for the purpose of blowing out or discharging the contents of the boiler under pressure, substantially as and for the purpose set forth.

(Signed) MORRIS L. KEEN.

Witnesses—
JAMES THOMPSON.
ELIJAH SHARP.

81 EXHIBIT "O[1]."

Whereas Morris L. Keen, of Roger's Ford, Montgomery County, and State of Pennsylvania, by instrument in writing, bearing date eighteenth day of May, A. D. eighteen hundred and sixty-three, conveyed to Benjamin Buffum, of the city and county of Providence, State of Rhode Island, as trustee for the American Wood-Paper Company, an absolute and exclusive license to use his invention in boilers for making paper-pulp from wood, for which letters-patent of the United States were granted to him on the thirteenth day of September, A. D. 1859, in the

manufacture of paper-pulp as aforesaid, within and throughout the United States of America, for the full term for which said letters-patent were granted, and during any extension or renewal thereof: Now, therefore, I, the said Benjamin Buffum, in consideration of one dollar and other valuable considerations, received to my full satisfaction from said American Wood-Paper Company, a corporation created by the general assembly of the State of Rhode Island, do hereby transfer and convey unto said corporation, their successors and assigns, all the right, title, and interest in said letters-patent, and in the invention therein described conveyed to me, as trustee, by the instrument aforesaid, and I do hereby substitute the aforesaid American Wood-Paper Company, their successors and assigns, to all powers, rights, and privileges granted to me by the instrument aforesaid, and secured to me by the covenants therein contained and set forth.

In testimony whereof I have hereunto set my hand and seal this sixteenth day of June, A. D. eighteen hundred and sixty-five.

(Signed) BENJAMIN BUFFUM.

Executed and delivered in presence of—
ALFRED K. HALL.
ALFRED R. KING.

82 U. S. rev. stamp, 50 cents. U. S. rev. stamp, 5 cents.

EXHIBIT "P."

This indenture, made this eleventh day of July, A. D. 1865, by and between Morris L. Keen and the American Wood-Paper Company, witnesseth that I, Morris L. Keen, in consideration of the sum of one dollars received, to my satisfaction, of the American Wood-Paper Company, do hereby assign and convey to them all my right, title, and interest in and to letters-patent of the United States, which were granted to me on the thirteenth day of September, A. D. 1859, for my invention in boilers for making paper-pulp: To have and to hold the same to the said American Wood-Paper Company, their successors and assigns, for the full term for which said letters-patent are granted, and for any extension thereof.

And the said American Wood-Paper Company, in consideration of said conveyance, do hereby covenant with said Morris L. Keen, that they will convey to him, or to such person as he may appoint, whenever he may make request therefor, a territorial or other license for the use of said inventions in the manufacture of any other article than paper-pulp, and which does not come into conflict with the rights heretofore granted by said Keen to Benjamin Buffum for the use of said company, by instrument dated May 18th, 1863, and will reconvey to said Keen the title hereby acquired, whenever it can be done without injury to the right of said company to sue for, or recover for infringements, and without impairing the exclusive rights they now hold under said patents.

In testimony whereof, the said parties have hereunto set their hands and seals, the said company by B. Buffum, their treasurer, this eleventh day of July, A. D. 1865.

MORRIS L. KEEN. [SEAL.]
AMERICAN WOOD-PAPER CO.,
By B. BUFFUM, *Treas.*

[CORPORATE SEAL.]

Executed in presence of—
JOHN RANDOLPH.
ALFRED K. HALL.
Witness to signature of B. Buffum.

83 UNITED STATES OF AMERICA,
District of Rhode Island, ss:

On the 14 day of October, A. D. 1865, before me came Benjamin Buffum, one of the parties interested in said bill of complaint, and who has signed the same in his capacity as treasurer of the American Wood-Paper Company, and he being by me duly affirmed, did depose and say: That he had heard the said bill read, and knew the contents thereof, and that the same was true of his own knowledge, except as to the matters which are therein stated on information and belief, and that as to those matters he believed it to be true. And the said Benjamin Buffum did further depose and say, that he did verily believe that the said Charles Watt and Hugh Burgess were the original and first inventors of the inventions and improvements described and claimed in Schedules A and B in said bill named, as annexed to the re-issued letters-patent therein set forth, and copies of which are annexed in said Schedules A and B.

And the said Benjamin Buffum did further depose and say, that he did verily believe that Marie Amédeé Charles Mellier was the original and first inventor of the invention and improvement described and claimed in Schedule E in said bill named, as annexed to the letters-patent therein set forth, a copy of which is annexed in said Schedule E, for a new and useful improvement in making paper-pulp.

And the said Benjamin Buffum did further depose and say, that he did verily believe that Morris L. Keen was the original and first inventor of the inventions and improvements described and claimed in Schedules L and M in said bill named, as annexed to the letters-patent therein set forth, copes of which are annexed in said Schedules L and M.

SAM'L W. PECKHAM.
United States Commissioner for said District.

[U. S. int. rev. 5-c't stamp.]

84 UNITED STATES OF AMERICA,
Eastern District of Pennsylvania, ss:

I, Hugh Burgess, now residing at Roger's Ford, Montgomery County, and State of Pennsylvania, on oath depose and say, that I verily believe that Charles Watt and myself were the original and first inventors of the inventions and improvements described and claimed in Schedules A and B in said bill named, as annexed to the re-issued letters-patent therein set forth, copies of which are annexed in said Schedules A and B, one for a pulp suitable for the manufacture of paper, made from wood or other vegetable substances, and one for the process of treating wood and other vegetable substances in the manufacture of paper-pulp.

HUGH BURGESS.

Subscribed and sworn to this 23rd day of October, A. D. 1865, before me.

ANDREW H. SMITH,
U. S. Commissioner for said District.

[U. S. int. rev. 5-c't stamp.]

85 UNITED STATES OF AMERICA,
Eastern District of Pennsylvania, ss:

I, Morris L. Keen, of Roger's Ford, Montgomery County, and State of Pennsylvania, on oath depose and say that I verily believe that I was the original and first inventor of the inventions and improvements described and claimed in Schedules L and M, in said bill named, as annexed

to the letters-patent therein set forth, copies of which are annexed in said Schedules L and M, one for an improvement in boilers for making pulp from wood, and one for an improved boiler for making pulp.

MORRIS L. KEEN.

Subscribed and sworn to this 23rd day of October, A. D. 1865, before me.

ANDREW H. SMITH,
U. S. Commissioner for said District.

[U. S. int.-rev. 5-c't stamp.]

86 | *Answer.*

Circuit court of the United States, eastern district of New York.

THE FIBRE-DISINTEGRATING COMPANY *ads.* THE AMERICAN WOOD-PAPER COMPANY. } In equity.

The answer of the Fibre-Disintegrating Company, defendants, to the bill of complaint of the American Wood-Paper Company, complainants.

These defendants, saving and reserving to themselves, now and at all times hereafter, all manner of exception to the many errors, uncertainties and insufficiencies of said bill of complaint, for answer thereto, say:

That they do not know and are not informed, save by unreliable rumor, and the bill of complaint in this suit, whether or not said complainants are a corporation created by the legislature of the State of Rhode Island, and leave the complainants to make such proof thereof as they shall be advised is material; but these defendants admit that said
87 complainants transact business in the State of Rhode Island, and admit that these defendants are a corporation.

These defendants, further answering, admit that letters-patent of the United States were inssued to Watt & Burgess, bearing date the 18th day of July, 1854, for an alleged new and useful improvement in the manufacture of paper from wood, but on information and belief they deny that said Watt & Burgess were the first inventors of said alleged improvement, and deny that said alleged invention was not known or used by others, anterior to the alleged invention or discovery by said Watt & Burgess; but, on the contrary, the same was previously known and used and described by others as hereinafter mentioned and referred to.

And these defendants say that they do not know and are not informed, save by said bill of complaint, whether or not said Watt & Burgess did properly make application for said patent, and did comply with all the requirements of law, and did have said patent issued to them in due form of law, and leave the complainants to make such proofs thereof as they shall be advised is material.

And these defendants, further answering, say that they do not know and are not informed, save by said bill of complaint, whether or not said Watt & Burgess sold or assigned to Frederic B. Houghton, their right, title, and interest in said patent and alleged invention; or whether or not said Frederic B. Houghton sold and conveyed to William F. Ladd and Morris L. Keen, his right, title, and interest, in said patent and invention; or whether or not said several assignments or any of them were recorded in the Patent-Office; and leave the complainants to make such proof thereof as they shall be advised is material.

And these defendants, further answering, deny that said Ladd and

Keen, duly or in accordance with the statute in such case made and provided, surrendered said patent on account of a defective specification, or in accordance with the statute in such case made and provided,
88 or on account of any legal cause; or that, on the 5th day of October, 1858, a new patent of that date was duly issued for the same invention as was contained in said original patent.

And these defendants, further answering, deny, that, after the said 5th day of October, 1858, said Ladd and Keen did, on account of a defective specification, or in accordance with the statute in such case made and provided, or for any lawful cause, surrender said last-mentioned patent, or that they surrendered said patent for the purpose of having a defective specification corrected, or of separating the inventions therein described, or to have two new letters-patent, dated the 7th day of April, 1863, duly issued to said Ladd and Keen, as stated in said bill; on the contrary, these defendants are informed, and believe, and aver, that both of the aforesaid surrenders of letters-patent were for the purpose of obtaining re-issued patents for more than said Watt & Burgess were the first inventors of, and for inventions and things which they were not the first inventors of, and which were not in any way described or made known in any original specification filed by them, or in any model or specimens which they deposited in the Patent-Office of the United States, and that each of said re-issued letters-patent covered and patented more than said Watt & Burgess were the first inventors of, and more than they intended to patent at the date of the original patent to them; and covered what had been known, and used, and described by others prior to the time of the alleged invention by the said Watt & Burgess; and these defendants are advised and aver, and will insist, that both of said surrenders were fraudulent, and that all of said re-issued patents, and particularly the last two, were obtained fraudulently and by collusion between said Ladd & Keen, or one of them, and said complainants, and that all of said re-issued patents, and particularly the last two, are fraudulent, and are null and void.

89 And these defendants, further answering, say that they do not know, and are not informed, save by said bill of complaint, whether or not the copies annexed to said bill of complaint, marked, respectively, A and B, are correct copies of said last-mentioned two re-issued patents, and leave the complainants to make such proof as they shall be advised is material.

And these defendants, further answering, say that they do not know, and are not informed, save by said bill of complaint, whether or not said Ladd & Keen sold and assigned said last two mentioned letters-patent to Benjamin Buffum, trustee, as stated in said bill; or whether or not any such assignment was recorded in the Patent-Office; or whether or not said Buffum assigned or conveyed to said complainants his interest, or any interest in said letters-patent; and they leave the complainants to make such proof thereof as they shall be advised is material.

And these defendants, on information and belief, deny that, by virtue of any such patents and assignments, said complainants became, or ever were, possessed of or vested with any exclusive right to use the inventions in the United States, or elsewhere, patented by the last aforesaid two re-issued patents, dated the seventh day of April, 1863.

And these defendants, further answering, say that they are advised, and aver, and will insist, that the said two re-issued letters-patent,

dated the 7th day of April, 1863, were not, nor was either of them, for the same invention for which the original patent to them, dated the 18th day of July, 1854, was issued, or for the same invention as was the re-issued patent granted to said Ladd & Keen, dated the 5th day of October, 1858; but that, on the contrary, both of said re-issued patents, dated the 7th day of April, 1863, were for more than said original patent, and for more than the first re-issue thereon, and for different and other inventions; and that said re-issues of the 7th of April, 1863, are therefore fraudulent, and null and void.

90 And these defendants, further answering, on information and belief, say that said Watt & Burgess were not the first inventors of the alleged inventions patented by either of the aforesaid two re-issued letters-patent, dated the 7th day of April, 1863; but that, on the contrary, the same were previously known and used by others, and described by others, as hereinafter mentioned and referred to.

And these defendants, further answering, say that they are informed and believe that one Mellier, of Paris, France, mentioned in said bill of complaint, did obtain letters-patent of the United States for an alleged improvement in making paper-pulp, dated the 26th day of May, 1857; but they do not know, and are not informed, whether or not the paper annexed to the bill of complaint, marked E, is a correct copy thereof, or whether or not such patents were properly applied for, or issued in due form, and in conformity with the law as stated in said bill, and leave the complainants to make such proof thereof as they shall be advised is material.

But these defendants, on information and belief, deny that said Mellier was the first inventor or discoverer of the alleged invention so patented to him, and deny that said alleged invention was not known or used by others anterior to the time of the alleged invention or discovery thereof by said Mellier; but that, on the contrary, the same was previously known, and used, and described by others, as hereinafter mentioned and referred to.

And these defendants, further answering, say that they do not know and are not informed, save by said bill of complaint, whether or not said Mellier, by his attorney, Victor Beaumont, assigned his right and interest in the invention secured by said patent to Coe S. Buchanan; or whether or not said Buchanan instituted and prosecuted a suit in the United States circuit court for the northern district of New York, against Howland & Palser, or that the proceedings were had therein, and the judgment of the court was pronounced, or that a decree

91 was entered therein, as stated in said bill; or that said Buchanan assigned to said Buffum his right and interest in said patent and invention; or whether or not said Buffum ever confirmed to said complainants their alleged title, as stated in said bill; or whether or not any such assignments or transfers were recorded, as stated in said bill; and they leave the complainants to make such proof of said several allegations and statements as they shall be advised is material.

These defendants, further answering, deny that, by virtue of any letters-patent or assignments mentioned in said bill, said complainants became or ever were possessed of or vested with the exclusive right to use the alleged invention patented by the last-mentioned patent to said Mellier.

And these defendants, further answering, admit that letters-patent of the United States were issued to Morris L. Keen for an alleged improvement in boilers for making paper-pulp from wood, dated the 13th of September, 1859; but whether or not such patent was duly applied

for, or was granted in due form of law; or whether or not all the requirements of law appertaining thereto were complied with, as stated in said bill; or whether the copy annexed to said bill, marked "L," is a correct copy of such patent; or whether or not said Keen sold to Benjamin Buffum, trustee of the American Wood-Paper Company, an exclusive license to use the invention described in said last-mentioned patent; or whether or not such assignment was recorded, as stated in said bill, these defendants do not know and are not informed, save by said bill, and leave the complainants to make such proof thereof as they shall be advised is material.

These defendants, further answering, deny that said Keen was the first inventor of the alleged improvement for which said patent, dated the 13th day of September, 1859, was issued; and they deny that the same was not known or used by others anterior to the alleged invention or discovery thereof by said Keen; but, on the contrary,
92 the same was previously known, and used, and described by others, as hereinafter mentioned and referred to. And these defendants deny that, by virtue of said patent, and any license under, or assignment of the same, said complainants ever became or are possessed of the exclusive right to use the invention described in said patent.

And these defendants, further answering, admit, that letters-patent of the United States were granted to said Keen for an alleged improvement in boilers for making paper-pulp, dated the 16th day of June, 1863; but whether or not said patent was duly applied for, or was issued in due form of law, or all the requirements of the statute appertaining thereto were complied with; or whether or not the copy annexed to said bill, marked "N," is a correct copy of such patent; or whether or not Benjamin Buffum, by an instrument of assignment, dated the 16th of June, 1865, confirmed to said complainants any title; or whether or not said Buffum, by an assignment, dated the 11th day of July, 1865, conveyed to said complainants all his right and interest in said patent, dated June 13th, 1859, as stated in said bill, these defendants do not know and are not informed, save by said bill, and leave the complainants to make such proof thereof as they shall be advised is material.

These defendants, further answering, deny that said Keen was the first inventor of the alleged improvement for which said patent of the 16th of June, 1863, was granted; and deny that the invention therein described was not known or used by others anterior to any invention or discovery thereof by said Keen; but, on the contrary, the same was previously known and used and described by others as hereinafter mentioned and referred to.

And these defendants, further answering, deny that they have ever contrived to injure said complainants, or to defraud them of any profits, benefits, and advantages whatever; and these defendants deny that they have at any time heretofore manufactured or sold, or are now
93 manufacturing or selling, at Brooklyn, in the eastern district of New York, or elsewhere, large quantities, or any paper-pulp manufactured in accordance with the descriptions set forth in any of the aforesaid patents, or by the use of any process or machinery described in any of said patents; and they say that they have not, and do not use any invention or thing patented by any of said patents in the manufacture and sale of paper-pulp or otherwise, and that they have not in any way infringed, and do not in any way infringe any of said patents.

These defendants aver that if the said Mellier patent be valid the said re-issues of the Watt & Burgess patent are, for that additional reason, invalid.

And these defendants therefore insist that the said Watt & Burgess were not the first and true inventors of the improvements described in the said Mellier patent, nor of any or either of them; and that the said Mellier was not the first and true inventor thereof.

And these defendants will claim the benefit and advantage on the hearing of this cause of the objection that the bill of complaint in this cause is bad for duplicity, multifariousness, and inconsistency in claiming title to the same process or invention by and through two conflicting patents, whereby these defendants are subjected to much trouble, expense, and vexation.

And these defendants aver that the said Mellier was not, within the meaning of the patent act, the first inventor of the improvement or process mentioned in the said patent granted to his assignees.

And the said defendants aver that the fact that an increase of heat progressively facilitates the action of alkalies in disintegrating the organic forms of fibre-yielding materials was well known to the chemical world before Mellier's alleged invention, and before he applied for his said patent; and it was before that time a generally acknowledged fact among paper-makers that the greater heat they could get in boiling their coarser stocks in alkaline leys was an advantage; that it has been for many years the common practice to boil vegetable substances in alkaline solutions under pressure exceeding seventy pounds when bleaching has been required; that Lemuel W. Wright, now residing at 177 Clinton street, Brooklyn, did so at Stockport, Lancashire, England, at his bleaching-mill there, in the year 1840, and during three or four subse-
95 quent years, which manufacture was under and by virtue of a patent granted to the said L. W. Wright by the government of England, dated April 20, 1825, and certain other patents.

And the said defendants aver that the said Mellier did not discover any new effect produced by a pressure of 70 pounds, but only observed an improvement in degree but not in kind, where the pressure was increased up to 70 pounds, and a like improvement in degree as the pressure was increased beyond that, which did not, under the principles of the patent laws, entitle him to a patent for the application of the greater degree of heat; and that the same was not a patentable subject-matter.

And the said defendants aver that the last claim in the said Mellier patent is confined to a process for bleaching straw by boiling it in a solution of pure caustic soda from two to three degrees Beaumé, at not less than 70 pounds pressure; and that these defendants do not use straw—do not use caustic soda of the strength so specified—and always boil at less than 70 pounds pressure. But they claim the right to use that or any higher pressure in their process of reducing to pulp bamboo reeds, or any other vegetable fibres, and for that purpose to boil the same in pure caustic alkali, or any other chemical, at or above the said pressure.

And these defendants aver that the decree in the case of Buchanan v. Howland & Palser, set forth in the bill of complaint in this cause, has been appealed from, and that such appeal is now pending in the Supreme Court of the United States.

And further, that the claim of said Watt & Burgess, to be the inventors of the said Mellier process, was not set up in that case; but that the plaintiffs have since purchased that patent for a large sum of money, viz, $100,000.

And that just before the assignment by said Ladd & Keen to the plaintiffs, it was arranged between them and the plaintiffs that
96 the said re-issues, Nos. 1448 and 1449, should be obtained by the said Ladd & Keen for the benefit of the plaintiffs.

THE WATT AND BURGESS PATENT.

And these defendants, further answering, say that if, instead of the said original patent of 1854, there had then been granted to the said Watt & Burgess two patents of the same tenor and effect as the said re-issues of 1863 to said Ladd & Keen, such patents would have been void for want of merit and novelty. And the said re-issued patents are void for that reason if for no other.

That the process described in the original patent of 1854, to Watt & Burgess, for making paper-pulp from wood shavings has no novelty or merit, and cannot be favorably compared with other patents granted prior to that time in the United States, England, and France, for making paper from wood of different kinds.

That the said original process of Watt & Burgess would never have proved of any practical importance under any circumstances, but the plaintiffs availing themselves of the experience and discoveries of others since the issue of the said patent of 1854, especially in regard to processes for restoring the alkali used, and being aided by the high price of paper, have at length succeeded in making pulp from basswood and poplar chips, which serves to adulterate rags and mix with straw pulp.

That vast quantities of paper-pulp are made from different kinds of wood and other fibrous vegetable substances in the United States, England, France, and Germany, by a great variety of different processes of crushing, grinding, cleansing, and treating with various chemicals in a multitude of various forms. And such pulp is made into paper, white and colored, and sold at very moderate prices.

The following is a list of some out of the numerous patents granted in the United States, England, and France, for processes for
97 making paper from different kinds of vegetable fibrous substances, prior to the date of the said Watt & Burgess patent of 1854, and prior to the alleged invention of the said Watt & Burgess.

PATENTS GRANTED IN ENGLAND.

A. D. 1792, November 28, No. 1922.

Patent to Hector Campbell, for a process whereby flaxen, hempen, and other materials fit to make paper are boiled in a caustic lye, washed and bleached, and made into paper.

A. D. 1794, November 28, No. 2026.

Patent to Wm. Cunningham, for a process for making paper from rags, ropes, &c., by boiling same for a specified time in potash lye, the making of which is described. This is followed by a bleaching, another boiling in lye, and a final bleaching.

A. D. 1800, November 15, No. 2449.

Patent to John Trumbull, jr., for bleaching cotton, flax, hemp, and wool. The materials are steeped in lye, and put in a tight vat, where

they are subjected to a heat considerably above boiling. The patentee says, that this great heat adds to the dissolving power of the lye, so that it dissolves as much of the starch, resin, &c., as is removed by long boiling in lye. The ordinary processes of bleaching follow.

98 A. D. 1801, February 17, No. 2481.

Patent to Matthias Koops for manufacturing paper from straw, hay, thistles, waste and refuse of hemp and flax, and different kinds of wood and bark, fit for printing and other useful purposes.

The process is described: The materials are steeped in lime water, to which in some cases "crystal of soda or potash" may be added, afterward boiling in clean water in which in some cases a certain quantity "of crystal of soda or potash" may be dissolved, then washing and again boiling, after which pressing, when proceed to manufacture the material "into paper by the usual and well-known processes of making paper." In the case of straw or hay they are cut into portions of about two inches in length by a chaff-cutting machine. With thistles they are "cut when the bloom begins to fall therefrom,"—dried and cut into lengths of two inches; and with wood it is first reduced into shavings, then cut with the chaff-cutting engine into lengths "of about two inches," but "wood which contains much turpentine or resinous matter cannot usefully and beneficially be made into paper."

A. D. 1838, May 15, No. 7643.

Patent to James Vincent Desgrand, for making paper and pasteboard with wood. The patentee says that, of the different sorts of wood, that coming under the denomination of white wood, such as poplars, have been found to answer the best. The process may be described as follows: Trees, deprived of their bark, are cut into short logs; these are split into pieces, and the pieces again are chopped into chips. These chips are put into pits and covered over with "lait de chaux," which is in fact "water saturated with lime as much as it will admit." The chips remain in the bath from three to six weeks, according to the
99 temperature, which dissolves the glutinous parts of the wood. The residue is reduced to pulp by stamping. If for white paper, the pulp is submitted to the action of the several chemical products "which have the property of bleaching vegetable produce."

A. D. 1838, Aug. 15, No. 7772.

Patent to George Robert D'Harcourt, for making paper from the sheaves or covering leaves of Indian corn, &c., by first macerating or fermenting the same—then boiling in lime and oil—then treating the material as rags are treated.

A. D. 1838, Sept. 6, No. 7794.

Patent to Morton Balmanno, for the manufacture of paper from the herbaceous plants which partake of the nature of hemp or flax, &c.

Under this patent the treatment of these substances in the making of paper varies a little according to their nature; but they are generally washed and submitted to the action of steam, or boiled with caustic alkali, strained, and, if necessary, again put through the same process, after which they are reduced to pulp in a paper-engine, and bleached by the usual process, and the pulp made into paper and pasteboard in the usual way.

A. D. 1838, Nov. 3, No. 7850.

Patent to Edward Cooper, for making paper from the pulp made from sugar cane.

A. D. 1838, Dec. 1, No. 7883.

Patent to John Small, for making paper from fibrous materials obtained by crushing from the banana, palm, and the plantain trees.

100 A. D. 1839, Nov. 19, No. 8273.

Patent to Miles Berry, for making paper and textile material from esparto, &c.

A. D. 1843, June 15, No. 9787.

Patent to the said Lemuel William Wright, for making paper from straw, jute, wood, &c.

This patentee made fine white paper from straw and jute, at his paper-mill at Charlford, near Stroud, Gloucestershire, England, in the years 1844 and 1845, and before and after that time by boiling the jute, straw, &c., in caustic alkali under steam pressure.

A. D. 1844, July 10, No. 10252.

Patent to Moses Poole, for making paper from the broom plant, steeped, crushed, washed, pressed, and treated with a solution of lime, with or without soda, then washed, pressed and bleached, steeped in a bath of liquid chlorine, to which is afterwards added muriatic acid.

A. D. 1852, Feb. 23, No. 13979.

Patent to Jean Theodore Coupier and Marie Amédée Charles Mellier, for certain improvements in the manufacture of paper, and these are said to be two in number.

First. "Reducing vegetable matters into pulp by means of a solution of hydrate of soda or potash," and afterwards bleaching by hypochlorites of alumina or "hypochlorites."

The vegetable matters named are straw and barks of some trees, as willow, osier, and chestnut, flax, waste cotton, waste tows of hemp, jute, or surate.

Second. The mode described of employing nitric acid in manufacturing pulp from woods reduced to shavings. These woods may be pine, beech, ash, and elm.

101 AMERICAN PATENTS.

1802, Dec. 30.

To Burgess, Alison, and Hawkins, of New Jersey. For making paper from corn husks.

1830, 19th Feb.

To W'm Magaw, re-issued patent for fourteen years from 8th March,

1828. For making paper from straw, hay, or other vegetable substances, by boiling in lye, cleansing, and then treating like rags.

1830, 3d August.

To Lewis Wooster and Joseph E. Holmes. For "improvement in the mode of making or manufacturing paper for writing, printing, wrapping, and boards, from wood." The wood is reduced to shavings, and boiled in alkali of a certain strength.

1853, August 2d.

To Coupier and Mellier, for fourteen years, from May 7, 1851, the date of their French patent. For making paper from straw.

FRENCH PATENTS.

Letters-patent granted by the government of France, Feb. 7, 1838.

To Montgolfier frères. No. 9215, and certificates of addition thereto, dated October 5, 1838, October 16, 1838, &c. Brevets d'Invention, 1st series, 67th volume, pages 15 to 26, both inclusive, and Plate 2. For the manufacture of paper from wood, &c., by a compound process
102 of preliminary pulping and subsequent treatment in alkaline solutions under pressure.

In operating on wood the patentees give the following process:

1st. Choose the wood having the longest fibre.

2d. Macerate to aid the departure of the gluten, resin, &c.

3d. Facilitate such departure by boiling in an alkaline lye at high pressure.

4th. Submit the wood thus treated to the action of rollers.

5th. Boil in lye again as before.

6th. Bleach in the ordinary way.

The second certificate of addition, dated October 16, 1838, describes a process of first reducing the wood to shavings; then immersing them five or six days in quicklime; then grinding in a sort of drug-mill; then boiling in a close vessel, "with a solution of pofash rendered caustic by the addition of lime, and boiled under pressure for twelve hours." The material is then washed in hot water and bleached.

Letters-patent granted by the government of France, May 12, 1838.

To Charles Wise. Brevets d'Invention, 1st series, volume 43, pages 37, 38, 39, and 40, and plates therein referred to. For boiling vegetable fibrous substances in caustic lye under pressure in a rotary boiler like Spofford's hereinafter described.

103 Letters-patent granted by the government of France, March 12, 1839.

To Moinier-Legoux. Brevets d'Invention, tome 52, pages 413, 414, and 415, and plate. For the manufacture of paper from wood, &c., by a process similar to that of Montgolfier just mentioned. The wood is macerated and soaked in caustic lye, and boiled in a boiler under a pressure of three or four atmospheres.

Leters-patent granted by the government of France, February 12, 1846.

To Le Sieur Cothon, Breuil à Paris. Brevets d'Invention, 2d series, volume 6, pages 60 and 61, No. 1440. For the employment of the bark of vegetables in the fabrication of paper. The patentee speaks of rods of willow and osier. They are to be barked by a certain process, and the patentee says that the first thing is to submit the material to a boiling in lye of salt of soda for five or six hours under a steam pressure of two or three atmospheres. Afterwards, the stuff is ground, washed and boiled again in green soap, then washed, &c.

Letters-patent granted by the government of France, March 20, 1847.

To Le Sieur Gros, aux Batignolles (Seine.) No. 2666. Brevets d'Invention, 2d series, pages 94, 95, and 96. For the employment of the broom-plant in making paper. By the process described the broom-plant is bruised, and the wood, deprived of its bark; after the operation of bruising, is subjected to the action of lye in a close vessel, with a pressure of three or four atmospheres. The wood is then washed and bruised again, and is again boiled in lye as at first; then
104 washed and bleached by gas and chloride of lime. By which process excellent paper is made.

The lye used is fifteen to twenty per cent. of the volume of water of salt of soda (sel de soude) rendered caustic with about five per cent. of quick-lime.

Letters-patent granted by the government of France, May 17, 1851.

To Messrs. Coupier & Mellier. Brevets d'Invention, 2d series, 19th volume, pages 145, 146, and 147. By this patent the herbs, bark, and wood to be treated are exposed to the action of a solution of hydrate of soda or potassa, of eight or ten degrees Beaumé for ten hours, at one hundred to one hundred and ten degrees centigrade; and the patentees say that the alcaline hydrate dissolves completely the resinous matters contained in the vegetables and frees them from silex.

THE SPOFFORD ROTARY PULPING-BOILER.

And these defendants, further answering, say: That George Spofford, of Windham, in the State of Connecticut, did obtain letters-patent of the United States, dated September 2d, 1840, for a new and useful process for preparing rags and other materials for making pulp in the manufacture of paper, and of the machinery for carrying the same into effect.

Which invention consisted in digesting, with an alkaline or other liquid in a close turning vessel, the rags or other fibrous materials for making paper-pulp, the heat being applied to the exterior of the vessel, or by steam introduced within it, as might be deemed most expedient. Which said letters-patent were re-issued upon an amended specification 11th June, 1850. And the said patent describes a close cylindrical boiler, and contains the following passage:

"The body of the boiler should be made of iron boiler-plate or
105 other suitable material, strong enough to resist any internal pressure to which the machine may be subjected, and of any convenient dimensions. One ten feet in length and four feet in diameter

will hold as a proper charge, about one thousand three hundred pounds of rags, with the appropriate quantity of lye, say about one hundred gallons of a solution of potash, soda, or lime, in water. When other material than rags are to be operated upon, as for example, straw, cotton-waste, &c., the proportions of the charge will vary, but these variations can easily be seen by the operator."

And these defendants, further answering, say that soon after the issue of the said letters-patent in 1840, many boilers were made and put in use under and by virtue of the same, by paper-makers in various parts of the United States, and were used by them for the purpose of making paper-pulp from cotton-waste, cotton, and linen rags, manilla, straw, and other vegetable substances, by boiling such substances in caustic alkali, under steam-pressure exceeding that of the atmosphere, in such boilers as aforesaid, which soon became known among paper-makers as Spofford's rotary boiler.

That the said George Spofford did, at Willimantic, in the State of Connecticut, soon after obtaining the said patent, viz., in the year 1841, and thence up to the time of his death, in the year 1850, use one of such boilers in the paper-mill there in which he at that time made paper, and did boil vegetable substances called rags in such boiler, in caustic alkali, under a steam-pressure exceeding that of the atmosphere, viz., about 30 to 50 pounds pressure, and did make paper-pulp and white paper from the same; and did, during part of that time, boil in such boiler other vegetable substances called straw, in caustic alkali, under steam-pressure, viz., from about 50 to 60 pounds to the inch.

That, in the year 1852 and 1853, and before the alleged invention of the said Watt & Burgess, Henry Beach, and Thomas Howland, paper-makers, did, at Fort Edward, in the State of New York, use one of the said Spofford rotary boilers for the boiling of vegetable sub-
106 stances in caustic alkali, under pressure, viz., from 25 to 50 pounds, for the purpose of making white paper from such vegetable substances.

That the said Thomas Howland now resides at Stockport, in Columbia County, in the State of New York, and the said Henry Beach resides at Chicago, in the State of Illinois.

That Jasper Harding, of Philadelphia, in the State of Pennsylvania, used, at Trenton, New Jersey, in the year 1843 or 1844, and continued for some years thereafter to use, one of the said Spofford rotary boilers, which was made to stand a pressure of at least 50 pounds to the inch, and did, at that time, boil in the said boiler vegetable substances in caustic alkali, under steam-pressure, viz., at about 20 to 50 pounds, for the manufacture of white paper.

That the said Jasper Harding departed this life about two years since.

That Cady Hollister, in his paper-mill, at or near Ballston, in Saratoga County, State of New York, did, in the years 1852 and 1853, use one of the said Spofford rotary boilers to boil therein rope and cotton and linen rags, in caustic alkali, under steam-pressure, for the manufacture of wall-paper and printing paper, the rags being boiled at about 25 pounds pressure, and the rope at about 100 pounds.

That the said Cady Hollister at that time resided at Ballston, aforesaid.

That Messrs. Gaunt and Derrickson used, at their paper-mill, called the Phœnix Mill, near Morristown, New Jersey, in the year 1845, and in subsequent years, one of the said Spofford rotary boilers.

That the said Derrickson lives in Brooklyn, Long Island, and has a

place of business at 30 Beekman street, New York City; and the said Gaunt is dead.

That, before the year 1853, the said Spofford rotary boilers were used for the purpose and in the manner aforesaid, by Mr. Butler, at Paterson, New Jersey; by Messrs. Day & Lyon, at Portland, Maine.

107 That said Butler now resides at Paterson, aforesaid, and has a place of business at 61 Chambers street, New York City.

That, in the year 1841, and in each and every year thereafter, until the year 1855, the firm of A. & W. Orr & Co., (composed of Alexander Orr, William Orr, and one Austin,) at Bennington, in the State of Vermont, manufactured paper from rags and rope, and in such manufacture subjected said material to a pressure of upwards of seventy pounds to a square inch while boiling the same in a rotary vessel in a solution of caustic soda.

That many such boilers were used in England prior to 1853.

That Messrs. Smith, Winchester & Co., made at their factory at Windham, in the State of Connecticut, before the year 1853, many, viz., about thirty or forty of the said Spofford rotary boilers, each capable of holding a pressure of over seventy pounds, and sold the same to paper-makers in the United States, to be used by them for the boiling of vegetable substances in caustic alkali, (generally made of lime and soda-ash,) such boiling being in such closed boilers as aforesaid, under steam-pressure, for making paper-pulp for white paper and for other paper; and the same boilers were used in the United States for such purpose before the year 1853, by the purchasers of such boilers, especially for converting rags, rope, sacks, and cotton-waste into paper-pulp.

That Isaac Goddard, of Worcester, Mass., made at that place, before the year 1855, and sold the said Spofford rotary boilers to paper-makers in the United States, to be used by them for the purpose of boiling vegetable substances in caustic alkali, under steam-pressure, for the manufacture of paper from such vegetable substances so treated. And the purchasers thereof used them for that purpose prior to the said year 1853.

And many other manufacturers made the said boilers for sale, among others Woodruff & Beach, of Hartford, in the State of Con-
108 necticut; John L. Severns, of Worcester, in the State of Massachusetts; N. Gavitt, of the city of Philadelphia; and Mr. Clute, of Schenectady, in the State of New York.

That in every case, as is well-known to the trade, where a paper-maker has used a Spofford rotary boiler, he has used it for the purpose of boiling vegetable substances in caustic alkali, under pressure, for the purpose of making paper from such substances.

THE WATT & BURGESS PATENT.—RE-ISSUE OF 1858.

And these defendants aver that the process described in the said original patent of 1854, was wholly useless and impracticable of application to bamboo and reeds, which these defendants convert into paper-pulp; said process being merely for a double application of alkali to wood-shavings or other minutely-divided vegetable substances, upon which the chemicals could act or operate in the way described in said patent.

And that upon the re-issue of the said patent, in 1858, the Patent-Office required the claim to be confined, as it was in the original patent, to "shavings of wood and other similar vegetable matter," and it was so confined accordingly.

But now, it is sought by the plaintiffs to establish that the original claim of invention of Watt & Burgess is to be read so as to include bamboo and reeds, as well as all other vegetable substances, and so as to debar those persons from using the same, who, before the said re-issues of 1863, embarked in the business of making such vegetable fibrous substances available for paper-making.

And these defendants insist that the said re-issue of 1858, was improperly obtained and improvidently issued, and without due warrant of law, and that the same is void.

109 THE WATT AND BURGESS PATENT.—(THE TWO RE-ISSUES OF 1863.)

And these defendants, further answering, show that the substance of the specification of the said original patent of 1854, granted to the said Watt & Burgess is as follows:

"The wood or vegetable substances upon which it is intended to operate by this process should first be reduced to very fine shavings or cuttings—the finer the better. This may be done in any suitable machine. The shavings are then to be boiled in a solution of caustic alkali."

Some suggestions are then made as to the strength of the alkali, and the specification proceeds as follows:

"We find boiling in a solution of caustic alkali, under pressure, of considerable service. We do not claim this operation as a part of our invention. The shavings are then to be well washed and pressed, and the washings may be saved and evaporated down and burned in a suitable furnace, when they are again available for the same purpose. The damp shavings are now to be exposed to the action of chlorine or the compounds of chlorine with oxygen till on a portion being placed in a dilute solution of caustic alkali the vegetable substance falls into a dark pulpy mass."

It then shows how this part of the process may be conveniently effected and the specification proceeds thus:

"The pulp, obtained as above described, having been freed from the alkali by washing, (which may be saved as before directed,) may now be bleached by the usual process, or, as we prefer, by chlorite or hypochlorite of soda or potash, liberating the chlorous or hypochlorous acid, by hydrochloric acid.

"Having thus fully described the nature of our invention, and
110 shown how the same may be reduced to practice, we wish it to be distinctly understood that we do not confine our claim to the apparatus or utensils, or the manipulations herein named, as they may be varied to suit the circumstances of the case.

"But what we do claim as our invention, and desire to secure by letters-patent, is the pulping and disintegrating of shavings of wood and other similar vegetable matter for making paper by treating them with caustic alkali chlorine, simple or its compounds, with oxygen and alkali, in the order substantially as described."

And these defendants further show to this court, that the alleged novelty of the invention consists in the second application of alkali after the use of chlorine; which process was not new, but has been found to be useless and is not used by the plaintiffs.

That the said Watt & Burgess, upon their application for the said patent, and in reply to an inquiry from the Patent-Office, stated and admitted the scope and extent of what they then claimed to have in-

vented, and declared that the following order and series of processes was what they claimed as their invention, and nothing more:

"First. The shavings are boiled in a solution of caustic alkali until, by the test of washing, they have lost their woody taste, (for white-pine shavings about three hours,) when they are washed and pressed to rid them of the alkali.

"Second. They are then subjected to the action of chlorine or its compounds, and oxygen until, by testing a portion in a dilute solution of caustic alkali, it falls into a dark pulpy mass, when it is again washed and pressed to remove the hydrochloric acid, which is the result of this process.

"Third. The material is then subjected to a weak solution of caustic alkali, when it falls into a pulpy mass of a dark brown color. It
111 is then again washed, to free it of the alkali, and may be bleached by any of the known processes.

"The shavings must pass through these several processes, and in the order stated, and this constitutes the invention."

And the defendants further show that such statement and admission was made in reply to a letter from the examiner, dated 24th March, 1854, containing the following passage:

"There are at least forty applications for patents, or patents themselves on record, for processes of treating vegetable fibre, and in a large part of these alkali and chlorine, or its compounds, are used. Under these circumstances the statement of the nature of the invention, the disclaimer, and the claim, do little to distinguish any novelty in the invention. Instead, therefore, of rejecting your claim, as must inevitably be done if decided in its present form, the papers are given to you for your further action in the case."

And these defendants claim and insist that the said Watt & Burgess did not invent anything more than they thus stated and admitted they had invented. And the said original patent of 1854, and the re-issues thereof, are void for any excess beyond the same, as the said Watt & Burgess were not the original and first discoverers or inventors of the thing patented; at all events, except so far as they have stated and admitted as aforesaid.

And these defendants further aver that the process described in the said original patent had no merit nor substantial novelty; that a process substantially similar had been used by others, and is described in Regnault's Chemistry, volume 2, pages 447–48.

And these defendants further say that, in the patent granted to said Watt & Burgess, in England, on August 19, 1853, No. 1942, referred to in their said American patent, the "nature of the invention" is thus described:

"We take, for instance, chips, shavings of wood, or sawdust, and boil for some hours in water.

112 "A stream of sulphurous acid is passed through the mass till a partial bleaching is effected.

"The matters are then well washed and placed in a solution of chlorine, chloric, or chlorous acid. The matters are kept in the solution till quite white, and the fibres are disintegrated, or we employ chloride of sodium decomposed by electric agency.

"After the above treatment we treat the fibrous mass in a warm and dilute solution of caustic soda or potash."

The manner of performing the process is stated. And the patentees state that "the wood or vegetable substances upon which it is intended to operate by this process should be reduced to very fine shavings or cuttings—the finer the better."

It is then stated that "these shavings are then to be "boiled in a solution of caustic alkali," and that the strength of the alkali varies according to the nature of the wood.

And the patentees say: "We find boiling in a solution of caustic alkali under pressure of considerable service. We do not claim this operation as a part of our invention.

The specification states that the shavings are then well washed, then exposed to the action of chlorine or its compounds, in the manner stated, then washed, then put in a weak solution of caustic alkali; then washed and bleached by the usual process.

And the claim is as follows:

"In the above processes we do not confine ourselves to the particular apparatus or utensils herein named, but claim the use of the chemical processes, and in the order herein named."

And the defendants further state that the said Watt & Burgess obtained a patent in France, dated September 28, 1853, for the same invention described in their said English patent, (Brevets d'Invention, 2d series, volume 29, pages, 190, 199,) in which no mention is made about boiling under pressure.

113 And these defendants aver that the said worthless patent of 1854, has been metamorphosed by the re-issue process into two patents, which are not, nor is either of them, for the application of alkali, chlorine, and alkali, in the order specified in the original patent, nor in any other order, when brown, colored, or unbleached paper is to be made, but the said re-issued patents contain nothing on that subject except in the treatment of vegetable substances of a resinous nature, to be made into white paper, which process is not practised by the plaintiffs nor by others; but such re-issued patents are for the boiling of all vegetable substances in caustic alkali, under pressure and heat of from 300 to 500 degrees, which embraces the principle of the Mellier patent set forth in the complaint.

And these defendants aver that, on the applications for the said two re-issued patents, the said Ladd & Keen presented two petitions, each stating the issue of the said patent of 1854, and the re-issue of 5th October, 1858, and the assignment thereof to said Ladd & Keen; and that the petitioners believed that the re-issued patent was inoperative and invalid by reason of a defective specification, which defect had arisen from inadvertence and mistake. They, therefore, prayed that they might be allowed to surrender the same, and requested that two new letters-patent might be issued to them.

And on the said application the said Ladd & Keen made affidavits to the effect that, by reason of an insufficient or defective specification, the aforesaid patent, re-issued in 1858, was not fully valid and available to them, and that said error had arisen from inadvertence, accident, or mistake, and without any fraudulent or deceptive intention, to the best of their knowledge or belief.

And these defendants aver, that no oath or affirmation was made, as required by the patent act, that said Watt & Burgess were the original and first inventors or discoverers of the improvements or inventions patented as aforesaid by the re-issued patents, and that they did

114 not know nor believe that the same was not before known or used; but, on the contrary, the said Watt & Burgess, when they made the oath required by the patent act, expressly disclaimed the operation of boiling in a solution of caustic alkali, under pressure, as a part of their invention, and nothing is said in the original specification about any particular degree of pressure.

And these defendants aver that the said Ladd & Keen did not, in applying for such re-issues, depose or assert that said Watt & Burgess were such inventors, and had not such knowledge or belief as aforesaid.

And these defendants charge and insist that the said original patent of 1854, was not returned for correction and re-issue under the 13th section of the patent act of 1836, within the meaning of the patent act of 1837, section 5, and that the patentee did not desire several patents to be issued for distinct and separate parts of the thing patented by the said original patent of 1854, or by the re-issue thereof in 1858.

And these defendants say that what is claimed in the re-issued patent No. 1448, as a new article of manufacture, had been, by the plaintiffs themselves, or by their assignors, former owners of the said patent of 1854, or of its re-issue, sold to the public for more than two years prior to the application upon which said re-issued letters-patent of 1863 were granted.

And these defendants aver that the said original patent of 1854, was not inoperative or invalid by reason of a defective or insufficient description or specification; nor was the re-issued patent of 1858, inoperative or invalid for such reason.

And these defendants insist that there was no legal authority for the issue of the said re-issued patents, or any or either of them, and that they were improvidently issued, and that they were improperly obtained, and that the same are void.

115 And further that the said Watt & Burgess, and Ladd & Keen, and the plaintiffs claiming under them, are estopped by the disclaimer in the said original patent of 1854, from retracting the same, so as thereby to injure those who have since engaged in the business of paper-making in the United States.

And these defendants say that said Watt & Burgess did not, on or prior to the 19th day of August, 1853, invent or discover the process of boiling vegetable fibrous substances in caustic alkaline solutions, under a steam pressure at or near or above 300 degrees of Fahrenheit's scale, so as to be entitled to a patent for the same under the patent laws of the United States.

And further, that the said Watt & Burgess did not, at the time last mentioned, know that there was any special efficacy in the degree of pressure last above specified in the manufacture of paper-pulp. And if they had any ideas on the subject at all, did not actually reduce the same to practice so as to be entitled to a patent at that time.

And further that neither they nor the parties claiming under them, as shown by the bill of complaint, did at any time use the high pressure in question for the purpose aforesaid, until after said Mellier's patent had been issued; and such high-pressure is mentioned in the said re-issue of Watts & Burgess' patent, on 5th October, 1858, more than a year after the said Mellier patent had been taken out in the United States.

And these defendants aver that the said Ladd & Keen, in their character as assignees of said Watt & Burgess, did, on their said application for the said re-issues in 1863, state and admit that the said Watt & Burgess were not, at the time of their application for the said original patent of 1854, the inventors of the process of boiling in alkaline solutions under pressure, vegetable fibres which had been previously partially prepared, but claimed as the invention of the said Watt & Burgess "the production of a perfect pulp by the sole action of alkaline solutions, under a given pressure."

116 And these defendants aver, that the said statement and admis-

sion are binding upon the plaintiffs as assignees of the said Ladd & Keen.

THE DEFENDANT'S PROCESS.

The said defendants, further answering, say that they have, since the fall of 1864, made paper-pulp at their works at South Brooklyn, from bamboo and other vegetable fibres, but almost exclusively from bamboo, and have had the same made into paper, and have sold the same, or part thereof, but not as yet in sufficient quantities to yield any profit.

And that the process by which the said paper-pulp has been made is substantially as follows:

The bamboo in lengths of about five feet, split lengthwise into two or three pieces, is put into a steam cylinder, called a gun, and after being therein subjected for about fifteen minutes to a steam pressure of about 170 pounds, is projected from such cylinder into the atmosphere by the force of the steam in such cylinder. The fibres of the bamboo are thus disintegrated and the principal part of the gum, silex, and other useless matters, can be washed out by the application of water. This steam-blowing process is used by the said defendants under the patent granted by the United States, to Azel S. Lyman, of New York, on 3d August, 1858, and which patent has been duly assigned to these defendants.

The steam-blown bamboo is then put in a paper-maker's beating engine, and there for a short time beaten and washed. It is now pulp, fit for coarse paper. Caustic alkali is then put to the pulp, and it is boiled under a pressure of about 20 to 45 pounds, being a heat of about 234 to 275 degrees Fahrenheit's scale. A lower pressure will answer very well, but a little advantage may be gained by the higher pressure. And these defendants claim the right to boil said pulp under any pressure.

In some cases the pulp, after being boiled as aforesaid, is more thoroughly disintegrated by being subjected to the blowing pro-
117 cess a second time, that is to say, the contents of the boiler are blown directly, and with great force, into a tank by the pressure of the steam in the boiler.

But in some cases the defendants use a Spofford rotary boiler, and this last-mentioned blowing process is then omitted. Nor is it absolutely essential, after blowing from the guns and the preliminary pulping process before referred to.

The pulp, after being boiled, is washed and made into paper in the usual way; being bleached in the usual way when white paper is required.

The pulp being prepared as above-mentioned before being boiled in alkali, a small quantity of alkali suffices, and a short boiling at no more pressure than has been commonly used by paper-makers for more than a quarter of a century past.

The great heat used in the steam-blowing process renders the further application of great heat in the subsequent treatment unnecessary.

And these defendants further say that one of the said Watt & Burgess patents, as re-issued in 1863, being No. 1449, is for "The process of treating wood or other vegetable substances by boiling in an alkali under pressure as a process or preparatory process, for making pulp for the manufacture of paper from such woods or other vegetable substances, substantially as described."

That the claim in the said Watt & Burgess patent, as re-issued in the year 1863, being No. 1448, is as follows: "What we claim in this patent as the invention of Charles Watt and Hugh Burgess, as a new

article of manufacture, is a pulp suitable for the manufacture of paper, made from wood or other vegetable substances by boiling the wood or other vegetable substance in an alkali, under pressure, substantially as described."

And in each of the said patents there is the following explanation of what is meant by the words "under pressure:" "By the words 'under pressure,' is meant a pressure at near or above 300 degrees of Fahrenheit's scale, which is the ordinary pressure used, but a heat and
118 corresponding pressure of from 300 to 500 degrees may be used, according to the nature of the vegetable substance to be treated."

And these defendants further say that, according to the scale of the French Academy, 300 degrees Fahrenheit would represent a pressure of between 66 and 67 pounds to the square inch, and a pressure of 59 pounds is equal to 293.7 degrees Fahrenheit, and a pressure of 44½ pounds is equal to 275.2 degrees Fahrenheit.

And these defendants further say that they have not, in the manufacture of paper-pulp by their process, except for experimental purposes, used in the boiling of the pulp heat equal or near to 300 degrees Fahrenheit. But they claim and insist that they have the right so to do.

And the said defendants, further answering, deny that the said complainants are entitled to the relief or any part thereof in their said complaint demanded.

And these defendants pray the same advantage of their aforesaid answer, as if they had pleaded or demurred to the said bill of complaint.

And these defendants pray hence to be dismissed with their reasonable costs and charges in this behalf most wrongfully sustained.

R. W. RUSSELL,
President of the Fibre-Disintegrating Company, the above-named Defendants.

GEO. GIFFORD,
Sol'r, and of Counsel for Defendants.

UNITED STATES OF AMERICA,
Eastern District of New York, ss:

On the 15th of June, 1866, before me, personally appeared Robert W. Russell, and made oath that he is the president of the Fibre-Disintegrating Company, the corporation named as defendants in the above answer, and that by means of his said office he has acquired and possesses particular knowledge of the matters stated in said answer;
119 that he has read the above answer subscribed by him, and knows the contents thereof, and that the same is true, of his own knowledge and belief, except as to the matters which are therein stated on information and belief, and as to those matters he believes it to be true.

R. W. RUSSEL.

[U. S. int. rev. stamp, 5 cents, cancelled.]

Sworn and subscribed before me, this 15th day of June, 1866.
[NOTARIAL SEAL.] THEODORE RITTER,
Notary Public, City and County of New York.

On the 30th day of May, 1867, the following amendments to the answer of the defendant were filed in the clerk's office, under leave of the court, to stand as if filed on the 30th day of June, 1866, the date of filing the original answer, namely:

120 Circuit court of the United States, eastern district of New York.

THE AMERICAN WOOD-PAPER COMPANY
against
THE FIBRE-DISINTEGRATING COMPANY.

Amendments made to the answer of The Fibre-Disintegrating Company, to the bill of complaint in this cause, pursuant to an order entered therein, on the 21st day of May, 1867.

These defendants, for further and amended answer to the said bill of complaint, on information and belief, say that the said Mellier was not the first inventor of, and did not discover or invent at all, the use or application of steam-pressure, equal to or exceeding 70 lbs. to the inch, in the bleaching of straw for paper, but that some years before he applied for the said patent, and several years before he applied for the French patent therein referred to, and prior to the time of his alleged invention he was shown the straw-paper manufactory, at Chalford, Gloucestershire, England, belonging to and worked by Lemuel W. Wright, an American, then residing at Chalford aforesaid, in which the said L. W. Wright manufactured fine white paper from straw, by the process described in the said patent, granted to him by the English government in 1843, as stated in the said answer, and that he then and there had said process explained to him by said Wright.

And the said Mellier at that time had an opportunity of examining the said Wright's process of making white paper from straw, by boiling the same in caustic alkaline solutions, under a steam-pressure of 80 lbs., and above and below 80 lbs. to the inch, being pressures above and below that which the said Mellier claims by his said patent to have discovered the use of in connection with a solution of pure
121 caustic soda, of a certain specified strength, for the purpose of bleaching straw, as therein mentioned.

And that, on the above occasion, the said Mellier agreed to purchase of the said L. W. Wright a French patent, which he had obtained for the same invention as that for which said Wright obtained his said English patent.

That paper made by the said L. W. Wright, under his said process, was exhibited in the great Exhibition of the works of industry of all nations, in London, in the year 1851.

That said Mellier's claim in the said American patent for a process for bleaching straw, by boiling it in a solution of pure caustic soda, of a strength from two to three degrees Beaumé, at not less than 70 lbs. pressure, has been fraudulently expanded by the parties claiming to be his assignees, into a general claim of the use of 70 lbs. steam-pressure in the disintegration and pulping, not only of straw, but also other vegetable substances, whether crude or manufactured, and whether the alkali used be pure caustic soda or other caustic alkali, and whether the strength of the alkaline solution be of the specified strength, or otherwise, and whether the bleaching be as specified by the said patent, or otherwise.

And these defendants further say that the said Mellier was not the original discoverer or inventor of the use or application of steam-pressure above 70 lbs. to the inch for the purpose aforesaid, and as claimed by his said patent.

And the defendants, for further and amended answer to the said bill of complaint, say that the specification in the said patent granted to

said Watt and Burgess, in the year 1854, does not contain the whole truth in relation to the alleged discovery, or invention, for which it is claimed the said patent was granted, but that the alleged discovery, or invention, by the patentees, of the necessity of boiling resinous woods in an alkaline solution of the temperature of about 372° Fahrenheit, and non-resinous woods in such solution of a temperature of about 366° Fahrenheit, was concealed in the said specification, and in the re-issued patents, Nos. 1448 and 1449, and such concealment was made for the purpose of deceiving the public.

And these defendants, for further and amended answer to
122 the said bill of complaint, say that a patent was granted by the United States to the said Lemuel W. Wright, on the 27th day of March, 1847, for an improvement in the manufacture of paper from straw, jute, wood, and other fibrous materials.

That the process described in the said patent is for the boiling of straw, jute, wood, etc., in caustic alkaline solutions, under high steam-pressure; and the said patent also describes a pulping-boiler, with a discharge-cock for the discharge of the contents of the boiler by steam-pressure.

And the defendants hereby notify the complainants that they will put in evidence, and at the hearing rely upon, the said patent granted to the said Wright, for the purpose of establishing the want of novelty in the patents upon which this suit is brought, and especially upon the want of novelty in the said patents granted to Watt & Burgess, and the re-issues thereof, and the said patent to the said Mellier, and the said patents granted to the said Keen for improved boilers.

And these defendants, for further and amended answer to the said bill of complaint, say that, prior to any invention thereof by said Mellier, or said Watt and Burgess, the alleged inventions described in the letters-patent alleged to have been granted to the said Mellier, and the re-issued patents, Nos. 1448 and 1449, mentioned in the said bill of complaint, were described in printed publications anterior to the alleged inventions of the said Mellier and Watt and Burgess, and among others in those mentioned below; and the said defendants hereby give notice of the following several printed prior publications, for the purpose of establishing the want of novelty in the said alleged inventions, and each of them:

Berlage, Zu No. 35, Central Blattes fur Deutsch Papier-fabrikation. No. 35, May 15, 1852, at page 15, and note on said page.

Central Blatte upon the manufacture of paper in Germany, No. 27, Sept., 1852, page 449. Three communications. Article upon the manufacture of paper from cloth, waste, and straw, in England.

123 Industrie Austellung, Zu London, 1851, vol. 2, pages 329 to 342, and especially page 342, note 4, note 8.

R. W. RUSSELL,
President of the Fibre-Disintegrating Company,
the above-named Defendants.

S. D. LAW,
GEO. GIFFORD,
Solicitors, and of Counsel for Defendants.

UNITED STATES OF AMERICA,
Eastern District of New York, ss:

On this 28th day of May, 1867, before me, personally appeared Robert W. Russell, and made oath that he is the president of The Fibre-

Disintegrating Company, the corporation named as the defendants in the above amendment to the answer in this cause, and that, by means of his said office, he has acquired and possesses particular knowledge of the matters stated in said amendment; that he has read the above amendment subscribed by him, and knows the contents thereof, and that the same is true of his own knowledge and belief, except as to the matters therein stated on information and belief, and as to those matters he believes it to be true.

R. W. RUSSELL.

Sworn and subscribed before me, this 28th day of May, A. D. 1867.

THEODORE RITTER,
Notary Public, N. Y. City.

On the 21st day of September, 1866, the following replication was filed in the clerk's office, viz:

124 On the twenty-first day of September, A. D. 1866, the following replication was filed in the clerk's office, namely:

125 In the circuit court of the United States for the eastern district of New York.

THE AMERICAN WOOD-PAPER COMPANY
vs.
THE FIBRE-DISINTEGRATING COMPANY. } In equity.

The replication of The American Wood-Paper Company, complainants, to the answer of The Fibre-Disintegrating Company, defendants:

These repliants, saving and reserving to themselves now, and at all times hereafter, all and all manner of benefit and advantage of exception, which may be had or taken to the manifold insufficiencies of the said answer, for replication thereunto say that they will aver, maintain, and prove their said bill of complaint to be true, certain, and sufficient in the law to be answered unto; and that the said answer of the said defendants is uncertain, untrue, and insufficient to be replied unto by these repliants; without this, that any other matter or thing whatsoever, in the said answer contained, material or effectual in the law to be replied unto, and not herein and hereby well and sufficiently replied unto, confessed and avoided, traversed or denied, is true. All which matters and things these repliants are and will be ready to aver, maintain, and prove, as this honorable court shall direct; and humbly pray as in and by their said bill they have already prayed.

FRANCIS C. NYE,
Solicitor for Compl'ts.

126 (Indorsed:) United States circuit court, eastern district of New York. The American Wood-Paper Company vs. The Fibre-Disintegrating Company. Replication. Francis C. Nye, solicitor for complainants. Filed Sept. 21st, 1866.

127 This cause was thence continued to the October term of this court, A. D. 1867, when the same was set down for hearing, and was heard and continued to the November term of this court, when the cause was argued and submitted to this court for its decision. The cause was thence continued to the March term of this court, A. D. 1871, when the following decree was entered, namely:

128 At a term of the circuit court of the United States for the eastern district of New York, in the second circuit, held at the United States court-rooms, number 189 Montague street, in the city of Brooklyn, on Friday, the 24th day of March, one thousand eight hundred and seventy-one.

Present, Hon. Cha's L. Benedict, district judge.

THE AMERICAN WOOD-PAPER COMPANY
vs.
THE FIBRE-DISINTEGRATING CO.

This cause came on to be heard upon the pleadings and proofs, and was argued by counsel for the respective parties; and, thereupon, upon consideration thereof, it was ordered, adjudged, and decreed—

First. That the re-issued letters-patent of the United States set forth or referred to in the bill of complaint, Exhibit A in this cause,
129 being re-issue No. 1448, dated 7th April, 1863, and being a re-issue of letters-patent originally granted by the United States to Charles Watt and Hugh Burgess, dated July 18, 1854, and for which new letters-patent were issued to their assignees October 5th, 1858, have been duly assigned, and the same are held and owned by the plaintiff in this cause.

That the said re-issued patent, No. 1448, dated 7th April, 1863, is not a valid patent, but is utterly void, the product therein claimed as a new article of manufacture not being new, and the invention therein described not having been invented by the said Watt & Burgess when they made an application for the said original patent granted to them.

Second. And it is further ordered, adjudged, and decreed, that the re-issued letters-patent of the United States set forth or referred to in the bill of complaint in this cause, Exhibit B, being re-issue No. 1449, dated 7th April, 1863, and being a re-issue of letters-patent originally granted by the United States to Charles Watt and Hugh Burgess,
130 dated July 18, 1854, and for which new letters-patent were re-issued to their assignees October 5th, 1858, have been duly assigned to, and the same are now held and owned by the plaintiff in this cause.

That the said re-issued patent, No. 1449, dated 7th April, 1863, is not a valid patent, but is utterly void, the invention therein described not having been invented by the said Watt & Burgess when they made the application for the said original patent granted to them.

Third. That the letters-patent of the United States, granted to Marie Amédeé Charles Mellier, on the 26th day of May, 1857, for the term of fourteen years, from the 7th day of August, 1854, for a new and useful improvement in making paper-pulp, being one of the patents referred to in complainant's bill, is a good and valid patent; and that the said Marie Amédeé' Charles Mellier, was the original and first inventor of the improvements described and claimed in the said patent;
131 that the said complainants have a good and valid title to the entire interest in said patent. The court thereupon doth adjudge and decree that the said defendants infringed upon the said patent, and upon the exclusive rights of the complainants under the same, and are, therefore, entitled to recover of the said defendants all the profits, gains, and advantages which the said defendants have received or made, or which have arisen or accrued to them from said infring'ment of the said patent by the use of the improvement described and secured by the said letters-patent, granted May 27th, 1857, since January, 1864.

And it appearing that no profits had been made by the defendants by the infring'ment aforesaid, it is ordered, adjudged, & decreed that the complainants recover nothing of the defendants by reason of the infring'ment.

Fourth. That a perpetual injunction be issued in this suit in accordance with this decree, enjoining and restraining the said defend-
132 ants from using the said process secured by the said patent to the said Mellier as aforesaid; or infringing the exclusive rights of said complainants under the same.

Fifth. And it is further ordered, adjudged, and decreed that the letters-patent of the United States, set forth or referred to in the bill of complaint in this cause, Exhibit L, dated 13th September, 1859, granted to Morris L. Keen, being patent No. 25418, have not been infringed by the defendants, as alleged by the bill of complaint in this cause, the said patent being for a combination which the defendants have not used.

And it is further ordered, adjudged, and decreed that the letters-patent of the United States, set forth or referred to in the bill of complaint in this cause, Exhibit N, dated 16th June, 1863, being patent No. 38901, granted to the said Morris L. Keen, have not been infringed by the defendants, as alleged by the bill of complaint in this
133 cause, the said patent being for a combination which the defendants have not used.

Sixth. And it is further ordered, adjudged, and decreed that the said bill of complaint, so far as it relates to said re-issued patents No. 1448 and 1449, each dated 7th April, 1863, being re-issues of the said patent originally granted to the said Watt and Burgess; and also so far as the said bill of complaint relates to the said patent granted to the said Morris L. Keen, dated 13th Sept., 1859, and so far as it relates to the said patent granted to the said Morris L. Keen, dated 16th June, 1863, be, and the same is hereby, dismissed. And that no costs be allowed to either party.

CHA'S L. BENEDICT.

(Indorsed:) Circuit court U. S., eastern district. The American Wood-Paper Company vs. The Fibre-Disintegrating Company. Final decree filed March 24, 1871.

134 And thereupon, upon the rendering of the aforesaid decree, the said defendants, The Fibre-Disintegrating Company, by their counsel, at the same term of the said court at which the said decree was rendered, in open court, prayed an appeal from so much of said decree as sustained the said bill of complaint as to the patent granted to M. A. C. Mellier, mentioned in the bill of complaint, and adjudged and decreed that the said defendants in the said suit had infringed the said patent, and should be enjoined, as in the said decree mentioned; which appeal was by the court allowed.

A true extract from minutes of court.

[SEAL.] SAMUEL T. JONES, *Clerk.*

135 At a stated term of the circuit court of the United States of America for the eastern district of New York, held at the United States court-rooms, in the city of Brooklyn, on the 31st day of March, in the year of our Lord one thousand eight hundred and seventy-one.

Present, the Honorable Charles L. Benedict, district judge.

THE AMERICAN WOOD-PAPER COMPANY } In equity.
vs.
THE FIBRE-DISINTEGRATING COMPANY. }

And now, at this March term of this court, come the American Wood-Paper Company, the complainants in the above-entitled suit, by Francis C. Nye, their solicitor, and claim and pray in open court an appeal to the Supreme Court of the United States, at the next term thereof, to be held at the city of Washington, on the first Monday of December next, from so much of the decree of this court made in said suit at this March term, 1871, as dismisses their bill of complaint therein, so far as respects the two re-issued patents mentioned in said bill, and known as re-issues number 1448 and 1449, respectively; and also as respects the two patents granted Morris L. Keen, and dated, respectively, 13th September, 1859, and 16th of June, 1863, and mentioned in said bill, and from so much of said decree as relates to said several patents. And the said appeal is thereupon allowed by the court.

A true extract from minutes of court.

[SEAL.] SAMUEL T. JONES, *Clerk.*

136 In the circuit court of the United States for the eastern district of New York.

THE AMERICAN WOOD-PAPER COMPANY }
vs.
THE FIBRE-DISINTEGRATING COMPANY. }

Testimony taken under the 67th rule of the Supreme Court of the United States, in equity, November 13th, 1866.

Present, Mr. Nye, for complainants; Mr. Law, for defendants.

JAMES MCCRACKEN, being duly sworn on the part of complainants, deposes and says as follows, viz:

Q. 1. What is your name, age, residence, and occupation?

A. James McCracken; 61 years old; Bloomfield, N. J.; engaged in building a factory at Bloomfield, for the purpose of making a substitute for fur, made from bamboo.

Q. 2. Do you know anything of the defendants in this suit—The Fibre-Disintegrating Company? If so, state what business they have been engaged in and where.

137 A. I do know. I have been connected with the Fibre-Company, at South Brooklyn, for the purpose of making paper-pulp from bamboo and cane. I acted as superintendent of that company.

Q. 3. During what period were you superintendent of that company?

A. From about the middle of March, 1864, to the first of August, 1865.

Q. 4. Describe the manner in which they have manufactured paper-pulp and paper?

A. Our process was to take the cane or bamboo, after soaking it in water in what we called the soaking tank. It was taken from there and put into the steam-guns. There were five steam-guns up at South Brooklyn. They had others at Elizabethport, N. J. Steam was applied to it in the guns at a pressure of from one hundred and sixty to one hundred and eighty pounds to the square inch. Sometimes it went a little

higher, but it was not the intention to go higher. At that pressure it produced the best results. It was subjected to a pressure in the guns for from twenty to thirty minutes. It was blown from the guns. After it was blown out, coming in contact with the atmosphere, it was thrown into fibre to a greater or less extent. Some portions would not be fibred and other portions would be entirely fibred. It was blown into the blow-room, as we called it, which was sufficiently ventilated to allow the steam to pass out of the building, retaining the fibre by means of a wire-cloth. It was then taken and boiled in a large tank, but some of it was cut before it was put into the tank where the fibres were long. It was an open tank. It was boiled for five or six hours. Sometimes there was salt and lime put into it and sometimes lime alone, and sometimes nothing but water. This was merely preparatory to the boiling process with alkali. It was washed before it went into the alkali. Then it was taken from there to the alkali-boiler and put under a pressure with alkali from forty to sixty pounds to the square inch. It was boiled four hours. From there it was blown out into a receiving-tank, washed again, taken to the rag-engine, made sufficiently fine to be worked into a brown paper; and if we wished to make a white paper we had
138 to bleach it in a bleaching-chest or tank, and then it was put into the rag-engine again and reground. For when we were going to make white paper, we made it only half stuff before bleaching.

Q. 5. What strength of the solution of caustic alkali have they used?

A. We used various strengths, but the general strength that was used and found best was from two and a half to three degrees per pound of bamboo, but have used less and have used more. It has been as high as five.

Q. 6. How was the strength of this alkaline-solution measured?

A. By a hydrometer—by a Baumé. If my recollection serves me right, one pound of caustic soda would indicate about fifteen degrees to the gallon of water. Sometimes I have known it to exceed that, but oftener less.

Q. 7. How many gallons of the solution of caustic alkali were put into the boiler to a hundred weight of bamboo?

A. We always made a calculation every charge of the boiler. The stuff being in a wet state it was difficult to arrive at the exact quantity that there would be dry, but we determined that as near as we could by experiments—taking the pulp in the wet state and weighing it and then drying it and then weighing it again, and, if my recollection is correct, one pound of dry pulp required one gallon of the solution, but I am not positive. We were in the habit of taking these drums of caustic soda and dissolving them in large iron tanks. We would then make the solution very strong. It varied in strength, owing to the quantity of water that was put in; but in every change the strength of the liquor in this tank was tested by the hydrometer and proportioned then to the quantity of pulp to be treated in the boiler, as I have before stated.

Q. 8. Was the strength of the solution, that you have given, as from two and a half to three degrees per pound of bamboo, proportioned to the bamboo in the wet state or the dry state?

A. In the dry.

Q. 9. How many gallons of the solution of caustic soda were put in the boiler to a hundred weight of the bamboo in a wet state?

139 A. The amount of water was allowed for or calculated upon: in putting it into the boiler we then added the necessary amount

of caustic soda and water to perfectly submerge and make the pulp float, so that it would boil freely. This is as near as I can recollect.

Q. 10. What kind of boiler have they used? Describe its construction and the mode of applying the heat.

A. It was an egg-shaped boiler, seven feet in diameter, made of wrought iron, and, I think, some fourteen or fifteen feet high. It was not an ordinary boiler, (in shape I mean,) and it sat vertically. We had vertical pipes on the inside in which steam was introduced for boiling by radiation. The steam was not injected into the liquor, although we had a steam-pipe connected with the boiler which we could use at pleasure, if it was found necessary. The object of the steam-pipes was to prevent any condensation and preserve the liquor at the full strength at which it was introduced. There was a row of vertical pipes all around the interior circumference of the boiler, just as close to each other as they could well be put, in order to make the connections; they ran about the length of the straight part of the boiler. It was also supposed these pipes would hasten the process and quicken the boiling. There was a shaft or pipe ran down through the centre of the boiler, and on that shaft we had a propeller,—something like a propeller,—it was exactly in the form of the blade of a propeller, with four wings to it; the blade was near the bottom of the shaft, six or eight inches wide. It may have been three feet or more in diameter; I never measured it. And below that again, upon the same shaft, there was a washer, made octagon in shape on its sides, and it was thought that we could wash, under pressure, but it proved to be a failure. We also had in the top of the boiler, above the pulp, a diaphragm made of iron—light iron perforated—so that when we were boiling the pulp has a tendency to rise out of the liquid, and this diaphragm was to keep it submerged, allowing the liquor to pass through and preventing the pulp, although some of the pulp always would pass through. It was a stationary diaphragm. It was only when we had a full charge, that the diaphragm was of any use. The propeller, it was thought, when it was introduced, by its agitation of the pulp, that it would assist in still further disintegrating or opening the fibre and quicken or shorten the process of boiling, but it failed to do what we expected of it, and took considerable power to drive it. It was driven by a bevilled or mitred gear at the top. The shaft went through a stuffing-box on the top. The stuff we put in at a side man-hole, near the top. I think a part of the opening was above the diaphragm and part below. I am not certain but that all the opening was below the diaphragm. We had a large five-and-a-half-inch cock in the bottom for discharging the contents of the boiler. This cock was in the centre, at the bottom of the egg. It was opened by gear. It was too stiff and hard to work by hand. It was spur-gear, worked by a cross. There was no power applied, only hand-power. The heat was applied to the boiler through the vertical pipes, before described, by steam. The steam was introduced on the side near the top, on a line with the upper end of the vertical tubes.

Q. 11. Was the boiling in the solution ever carried on at a higher pressure than sixty pounds?

A. Never, unless it happened by accident; the intention was not to go higher. There was a safety-valve that would blow off at sixty.

Q. 12. Why did you intend not to exceed sixty pounds?

(Objection by the defendants.)

A. We were instructed not to go higher by the company, Mr. Russell; there were written orders, I believe; not positive, because we had understood—I had understood and had understood from others—that the

Buchanan patent, I think, if I remember right, covers everything above three hundred degrees of heat or seventy pounds of pressure; I am not certain who was the patentee, but it was some patent that we would interfere with if we went beyond that.

Q. 13. How was the temperature in the boiler measured?

A. We measured our pressure by the steam-gauge, and safety-valve also; we had nothing to measure the temperature except the steam-gauge and safety-valve, I think, while I was there.

Q. 14. How was the steam-gauge attached to the boiler?

141 A. By a steam-pipe, communicating with the interior. I am not positive whether with the steam-chamber or with the liquor.

Q. 15. How were the contents of the boiler discharged, and into what sort of a vessel?

A. They were discharged through the cock I have already described into a wooden vessel lined with lead, with a cover to prevent the steam from passing out into the room, to which was attached a chimney to convey the steam out into the open air. The contents were discharged through this cock by the pressure of steam in the boiler and by their own gravity.

Q. 16. Have you any specimens of the pulp produced by the process you have described? If so, produce them.

A. I have none.

Q. 17. What quantity of the paper-pulp have they made by the boiling process, to your knowledge?

A. It would be impossible for me to tell; never kept any account of it; it was not my part of the business.

Cross-examined by Mr. Law, for the defendants:

Q. 18. Was the shaft and its propeller or the stirrer used only as experimental or to test its action, or used constantly, in the boiler?

A. It was an experiment altogether.

Q. 19. Was its use continued or was it discarded and laid aside?

A. Part of the time it was used, and some of the time it was not used; Mr. Russell was rather in favor of it, and persisted in having it used, and it was through him that it was continued as long as it was.

Q. 20. Was it found from the experiments made with it that it served any good or desirable purpose?

A. It did not, but there was a serious objection; the arms or wings of the agitator and the steps upon which it stood forming a kind of bridge directly over the opening—the discharge-pipe I mean—sometimes preventing the stuff from flowing out; so much so as to choke it.

Q. 21. How long was any use of such agitator continued, and was it taken out of the boiler?

A. It was not taken out while I was there; at least I think not, I am not certain; it was no use, better out than in. We could per-

142 ceive no difference in the pulp after it had been blown from that which had been agitated and that which had not been agitated.

Q. 22. Was there any other boiler for boiling the pulp under pressure that was used at such works, except the one in which was this agitator?

A. None, except a small experimental boiler. We boiled in that. We also boiled in the open tank, using spent alkali and sometimes sal soda, in the small experimental boiler. We boiled pulp in that. We also had a rotary boiler, which I forgot to mention when the question was put to me; such a one as is ordinarily used in paper-mills, and called the Spofford boiler. We boiled in that, under pressure—the same amount of pressure we used in the vertical boiler.

Re-examined by the complainants:

Q. 23. Was the pulp produced by boiling in the boiler you have described with an agitator, constantly manufactured into paper?

A. Not at our place; it used to accumulate there. We made some into paper.

Q. 24. What was done with that which accumulated?

A. It was sent up to Stockport to be manufactured there into paper. I had no further charge of it after it left the mill.

Q. 25. Was it manufactured into paper at Stockport by the defendants?

A. It was. So I understood. I know nothing about it myself.

Q. 26. Were the contents discharged from the rotary Spofford boiler you have mentioned, under pressure?

A. They were not.

Q. 27. How were they discharged?

A. In the ordinary way; taking off the man-hole plates, allowing the boiler to revolve and discharge itself. The steam was first let off before we could take the man-hole plates off.

Q. 28. Did you use the same solution of caustic alkali in the rotary Spofford boiler as in the vertical boiler with an agitator, that you have described?

A. We did.

Q. 29. Did you employ the Spofford boiler for experiments, or for pulp to be manufactured into paper?

143 A. For pulp to be manufactured into paper.

Q. 30. Was the pressure in the rotary boiler gauged solely by a steam-gauge?

A. It was not used.

Q. 31. What else was used?

A. A safety-valve as well as the steam-gauge.

Q. 32. Was the safety-valve made to open at a higher pressure than seventy pounds to the square inch?

A. It was set at sixty, I think. I know it was the intention to run at the same pressure throughout.

Q. 33. Did the rotary boiler contain a perforated diaphragm?

A. It did: not a perforated diaphragm, but a diaphragm made from wire-cloth and a wrought-iron frame.

Q. 34. Describe this diaphragm, particularly its position, object, &c.

A. It was a circular head secured to the sides of the boiler, made in sections, covered with wire-cloth for the purpose of discharging the liquor and leaving the pulp behind, so we could save the spent alkali if it was worth saving.

Q. 35. Did you discharge the remaining pulp or contents after the liquor was drawn off through the diaphragm; If not, how?

A. No, sir; the diaphragm was in one end and the man-hole was on the surface sides of the boiler, equally distant from each end.

Q. 36. Did the boiler rotate on its horizontal or vertical axis?

A. On its horizontal.

Recross-examined:

Q. 37. Had the rotary boiler any agitator or stirrer in it?

A. It had projections like buckets; these were fixed to the sides of the boilers and revolved with it; it had no other stirrer.

Q. 38. When the vertical boiler was used for boiling pulp was the agitator always used, or was the belt frequently thrown off from the agitator shaft and the stirrer remain inactive?

A. It was frequently inactive.

144 Q. 39. Then you boiled pulps in that boiler frequently, without any use of the stirrer, did you?

A. We did.

Redirect for complainants:

Q. 40. Did you boil in the rotary Spofford boiler such material from bamboo or cane, and in the like solution of caustic soda, as in the vertical boiler with a stirrer?

A. We did.

Q. 41. For how long did you boil in the rotary boiler?

A. Three or four hours, or five hours; different lengths of time, according to the strength of the solution.

JAMES McCRACKEN.

Sworn to before me, this 13th day of November, 1866.

KENNETH G. WHITE,
Examiner, &c.

Adjourned to November 14, at 11 o'clock a. m.

NOVEMBER 14, 1866.

Present, counsel for respective parties.

JAMES McCRACKEN recalled and sworn for complainants.

Q. 42. What was the quantity of the solution of caustic alkali of the general strength of 2½ to 3° which you said was proportioned to a pound of bamboo?

A. The same as I stated yesterday—one gallon to a pound; but I state only from recollection, and may be mistaken. I have no data to go by in respect to the quantity per pound.

Q. 43. Did the strength of the solution ever fall below 2½°? If so, how much?

A. I think it did in some instances. The various experiments, which were numerous, were on written orders, and I was instructed to carry out those orders, and did carry out. I cannot tell the exact amount; it is impossible.

Q. 44. How much of the bamboo or cane was required and used to make one pound of dry pulp, to the best of your knowledge?

145 A. It is difficult for me to answer, for this reason, that there never was, during my time, an exact amount of bamboo weighed out and carried all the way through—I mean through the blowing, the washing, and the different boilings—and reduced to dry pulp or paper, so as to determine the exact loss in the material from the stick to the pulp; there was no data. It was generally understood and estimated among us, that the dry pulp was from 25 to 30 per cent. of the stick; that the yield was not over that. And I have heard some even go lower than twenty-five per cent.

(Last part objected to by counsel for defendants.)

Q. 45. Where were the steam-gauges attached to the vertical boiler and rotary boiler?

A. On the vertical boiler they were in front, about half way of the entire length of the boiler; I think it was. On the rotary boiler the steam-gauge was above the boiler, connecting at the rear end of the boiler with a stuffing box and journal.

Q. 46. What kind of steam-gauges were they; by whom made and tested?

A. I think they were made by Mr. Ashcroft, if my memory serves me correctly. They were dial-faces, and operated upon by the steam on the under side in the usual way. I do not know what kind. I can't say, positively, how they were made. On the steam-boiler they were tested by those who test boilers under the city authorities. We had the same kind of gauges on the tubular boilers and on the bulb boilers and on the vertical and rotary boilers, and also on the high-pressure boilers. On the return flue boilers we had a different gauge, a mercurial gauge. I do not know who tested them before they were put on to the boilers. I am not certain whether these authorities tested the gauges on the boilers in which we boiled pulp. But we compared them with the safety-valves and with the gauges which these men did test, and in some instances there was a slight variation among the gauges.

Cross-examined by defendants:

Q. 47. In the boiler from which the steam was taken to heat the vertical boiler in which pulp was boiled, what was the pressure allowed by the safety-valve?

A. We took from two different boilers sometimes, but generally from the bulb boiler. As I stated before, my impression is it was sixty
146 pounds, but there were times in which that bulb boiler was connected with the guns, and then the steam was much higher in the bulb boiler than it was in the boiler in which we were boiling the pulp, the pressure in which was regulated by its own safety-valve and gauge and cocks.

JAMES McCRACKEN.

Sworn to before me this 14th day of November, 1866.

KENNETH G. WHITE,
Examiner, &c.

JOHN H. FISHER, sworn on part of complainants, deposes and says:

Q. 1. What is your name, age, residence, and occupation?

A. Twenty-seven years of age; residence, Brooklyn; clerk of the Fibre-Disintegrating Company.

Q. 2. Do you know anything of the defendants, the Fibre-Disintegrating Company? If so, state what business they have been engaged in, and where, and for how long.

A. I do. They have been engaged in the manufacture of paper-stock and paper, at their works at Elizabethport, New Jersey, and South Brooklyn, New York, from bamboo, cane, straw, hemp, flax, and other vegetable fibrous materials, for about three years.

Q. 3. How long have you been in the employment of said company, and in what capacity?

A. Three years and two months, in the capacity of draughtsman and clerk.

Q. 4. How much paper-pulp and paper had they manufactured during that period, to the best of your knowledge?

A. I cannot tell exactly, but should say about a thousand tons, altogether.

Q. 5. Was this amount of paper-pulp and paper all made by boiling in a solution of caustic alkali, under pressure?

A. It was.

Q. 6. How many boilers were used for such boiling; of what kind; by whom made; and where obtained or bought?

A. Three boilers were used at Brooklyn and one at Elizabeth-

147 port. The Brooklyn boilers were of wrought-iron, one rotary, set horizontally, and two egg-shaped, set vertically; the one at Elizabeth of cast-iron, also set vertically. I do not know by whom made, nor where. The egg-shaped boilers were bought at Rahway, New Jersey. I don't know of whom; nor do I know where, or of whom the rotary or cast-iron boilers were bought. I do not know where they came from.

Q. 7. What were your duties in the capacity of clerk for the Fibre-Disintegrating Company?

A. Keeping account of the current expenses of the establishment, pay the men their wages, and lately keep an account of the quantity of material used with chemicals and amount of stuff turned out.

Q. 8. How many and what kind of steam-gauges were used by them, and of whom bought?

A. There were seven steam-gauges in use at Brooklyn; one on the high-pressure boilers, one on Harrison's boiler, one on engine-boiler, one on cylinder boiler, one on each egg-boiler, and one on rotary boiler. That on high-pressure boilers was of John Ashcroft's make, recently changed for one of Keen Brothers' make. Both of these were spring-gauges. That on the Harrison boiler was of John Ashcroft's make, also spring; that on the steam-engine boiler was mercurial—I don't know whose make; that on the tubular boiler was Ashcroft's make, also spring; those on the egg-shaped boilers, Ashcroft's spring; also that on the rotary boiler; and they were all bought of the makers.

Q. 9. By whom were these gauges severally tested?

A. Those on the various steam-boilers were tested by the health commissioner or board of inspectors, in Mulberry street. They were periodically tested with the boilers by these parties. I do not know whether they were tested before they were attached to the boilers. The gauges on the steam-boilers being properly tested, were considered as checks upon the gauges used upon the pulping boilers, allowing the difference between the pressure in the steam-boilers and the pressure in the pulping boilers, the distance between the two being sufficient to cause a loss of pressure by condensation and radiation. Those gauges on the pulping boilers were not tested in any other way.

Q. 10. Look at the pieces of paper shown to you and marked
148 by the examiner, Exhibits A, B, C, D, E, F, G, and H, respectively, and say if they were made by the Fibre-Disintegrating Company, at their mill in South Brooklyn, and of what material.

A. I cannot swear that this paper was made at our mill at South Brooklyn.

Q. 11. When did the defendants begin the manufacture of paper and paper pulp at South Brooklyn, and for how long did they continue such manufacture?

A. I think from the winter of 1864–'5 till the fall of 1865.

Q. 12. Have they not manufactured any paper-pulp or paper since the fall of 1865?

A. They have manufactured paper-pulp at their mill in Brooklyn since that period, but not paper. The paper was manufactured from the pulp made in Brooklyn, at the mill in Stockport, Columbia County, New York.

Q. 13. How much paper and paper-pulp, respectively, have been manufactured by the defendants at South Brooklyn, to the best of your knowledge?

A. I should think about three hundred tons of paper and five hundred tons of pulp.

Q. 14. What was done by the defendants with that pulp manufactured at South Brooklyn which was not there made into paper?

A. It was sent to Stockport, New York, for subsequent manufacture into paper.

Q. 15. What is the present condition in the manufacturing business of the company?

A. They have stopped the manufacture of all material.

JOHN H. FISHER.

Sworn to before me this 14th day of November, 1866.

KENNETH G. WHITE,
Examiner, &c.

ROBERT DONALDSON, sworn on part of complainants, testified as follows:

Q. 1. What is your name, age, residence, and occupation?

A. I am fifty-two years of age; reside in Brooklyn, and am in no business.

Q. 2. Do you know anything of the defendants in this suit, The Fibre-Disintegrating Company; and if so, what?

149 A. I know there was a company formed in Brooklyn; am acquainted with Mr. Russell, the president, and Mr. Bulkly, one of the directors. About a year ago, last May or June, I paid a visit to the factory, at the request of Mr. Bulkly, he knowing I had previously been a paper-manufacturer; and whilst at the factory I saw Mr. John H. Fisher, the last witness, who presented me with samples of paper which had been put in evidence, and marked Exhibits A to H, inclusive, who informed me that these samples were all made by the defendants at their factory.

Q. 3. Look at the pieces of paper shown to you and marked as stated in last answer, and say if you know they were made by the defendants at South Brooklyn; and if so, from what material, respectively.

A. I do not know they were made by them there. Exhibit "A" is made from pure bamboo. Exhibit "B" is three-quarters straw and one-quarter hemp. Exhibit "C" is three-quarters straw and one-quarter flax. Exhibit "D" is pure flax. Exhibit "E" is raw hemp. Exhibit "F" is rye straw. Exhibit "G" is three-quarters bamboo and one-quarter grass-rope, as known in the trade. Exhibit "H" is basswood.

Q. 4. Look at the piece of paper shown to you and marked by the examiner Exhibit "I," and say whether you know it was made by the defendants at South Brooklyn; and if so, from what material.

A. It was made by them of bamboo.

Q. 5. Were such pieces of paper so made by them, to your knowledge, by boiling such material in a solution of caustic alkali, under pressure, as practised by the defendants at South Brooklyn?

A. I was so informed by Mr. Fisher, from whom I received them, who marked at the time upon the pieces of paper he handed me, from which the exhibits are cut, the date, and the material from which they were made.

(Answer objected to as hearsay by defendants.)

Cross-examined by defendants:

Q. 6. What busin ess were you in when you went to the defendant's works at South Bro oklyn in May or June, 1865, and obtained the samples of paper you have testified to?

150 A. In no business.

Q. 7. What did you get such samples for?

A. As a matter of curiosity. The mode of manufacturing was something new.

Q. 8. Where have these samples been since you so got them?

A. Always been in my possession.

Q. 9. If you got them merely out of curiosity how happens it that you have retained them so carefully since that time?

A. I always preserve samples. I have some of my own I made more than twenty years ago.

Q. 10. Have you got all the samples of paper which you have taken from different parties for the last twenty years?

A. I can't say as to that.

Q. 11. Then you do not actually preserve all samples of paper which you have obtained from different sources, do you?

A. When I come across anything curious or strange I do.

Q. 12. Were you not, at or about the time you obtained these samples, a paper-broker, and has not that been your business?

A. No, sir. I have not sold any paper in five years.

Q. 13. You state, in your answer to the third direct interrogatory, that you knew the samples shown you were made by the defendants. Did you see them made?

A. Some of them I did not see made, and there may be one sample which I probably did see made, as I took it from a machine at the time it was making. I think Exhibit "A" is that one. The others I did not see made.

Q. 14. Have you any knowledge as to the material of which you say the several samples are made except what was told you by Mr. Fisher, or some one else?

A. I have no other knowledge, except what Mr. Fisher told me.

Q. 15. Did you see made the paper of which Exhibit "I" is a part?

A. No, I did not.

Q. 16. Have you any knowledge in what manner the several exhibits were made—how the material was treated with caustic alkali—except what you have been informed by others?

151 A. No.

Q. 17. Have you, at any time, except at the time you have mentioned, and if so, when, obtained from Mr. Fisher any samples of paper manufactured by the defendants?

A. Yes. I got some samples about a week or so ago. I never obtained samples but twice.

Q. 18. When you got the last samples, about a week ago, did you say anything, and if so what, about the first samples?

A. I told Mr. Fisher that the samples he gave me a long time before I had laid away, and could not, at that time, put my hands on them. But since then I have found them.

Q. 19. For what purpose did you tell Mr. Fisher that you wanted the samples which you last obtained from him?

A. I do not think he asked me the question. I have no recollection of telling him anything about it.

Q. 20. How came Mr. Fisher to give you the samples the last time?

A. I asked for them. I wanted to see what they had been doing.

Q. 21. Did you not tell Mr. Fisher that you was a paper-broker?

A. No, sir.

Re-direct:

Q. 22. Were you ever a paper-broker; and if so, when?

A. I have tried to sell paper, but never succeeded to any account.

Q. 23. Are you not certain that, at the time of your visit to the factory of defendants, in May or June, 1865, they were manufacturing paper from which you received a sample from Mr. Fisher, a part of which has been put in evidence as one of the exhibits?

A. Yes, sir, I do know. I refer to Exhibit "A."

Q. 24. Were you ever informed anything about the samples of paper put in evidence by anybody except Mr. Fisher?

A. No.

ROBERT DONALDSON.

Sworn to before me the 14th day of November, 1866.

KENNETH G. WHITE,
Examiner, &c.

152 Depositions of witnesses produced to, and sworn or affirmed and examined on the days and times hereinafter set forth by, Aubrey H. Smith, special examiner, at his office, No. 137 South Fifth street, in the city of Philadelphia, under and by virtue of an order, and an amended order made by the said court in the said cause, respectively, on the 12th and 29th days of December, A. D. 1866, for the examination of the witnesses therein named in the cause aforesaid.

OFFICE OF THE EXAMINER,
NO. 137 SOUTH FIFTH STREET, PHILADELPHIA,
January 16, 1867—11 *a. m.*

Present, Henry E. Wallace, esq., for the plaintiffs; George Harding, esq., for the defendants.

The examination of the witnesses is adjourned by agreement of counsel to Wednesday, Jan. 23, 1867, at 11 o'clock, a. m.

OFFICE OF THE EXAMINER,
NO. 137 SOUTH FIFTH STREET, PHILADELPHIA,
January 23, 1867—11 *a. m.*

Present, Mr. Wallace, for the plaintiffs; Mr. Harding, for the defendants.

HUGH BURGESS, one of the witnesses named in the said first-mentioned order of the court produced on behalf of the plaintiffs, being duly sworn, deposeth and saith as follows:

Q. 1. What is your name, age, residence, and occupation?

A. My name is Hugh Burgess. I am forty years old. I reside at Royer's Ford, and am a chemist by profession.

Q. 2. Have you any knowledge of the Fibre-Disintegrating Company?

A. I am aware that there is such a company known as the Fibre-Disintegrating Company, having visited the works of the company.

153 Q. 3. Have you ever visited and examined their works at Brooklyn? and, if so, state when and under what circumstances and what opportunities you had for such examination.

A. I visited and examined the works of the Fibre-Disintegrating Company, at Brooklyn, about September the 7th, 1865, having been furnished with a letter to Mr. Townsend, the manager of the works, by Mr. Russell, president of the said company, this letter being procured for me by a third party. I was shown all through the works by Mr. Townsend, who explained all I desired to know.

Q. 4. Describe the materials used by them in the manufacture of paper-pulp and paper.

A. The only materials adapted for conversion into paper-pulp seen by me on the premises of the company were bamboo and cane or cane-angle. At the time of my visit I understood that only bamboo was being used.

Q. 5. If, in answer to the last interrogatory, you say that fibrous vegetable substances were used in the manufacture of paper-pulp or paper, describe the manner in which these materials are prepared and used, and the processes to which they are subjected.

A. The method by which the bamboo or cane was prepared was as follows: The bamboo is crushed in the country where it is cut, in order to facilitate the baling. The cane I saw on the premises was uncrushed. This crushed bamboo is then disintegrated by being blown from a tube or gun by steam pressure, boiled in caustic alkali, under pressure, prepared and made into paper in the usual mode. When white paper is to be made it is bleached, after being boiled in caustic alkali under pressure.

Q. 6. If you say you saw the cane or bamboo subjected to any preliminary, mechanical, or other operation previous to being treated by any chemical process, describe these preliminary operations and their effect upon the cane or bamboo.

A. The preliminary operation to which the bamboo or cane was exposed previous to chemical treatment was as follows: The bales of bamboo were opened, and the crushed or split bamboo was made up into bundles of a size adapted to the bore of the tube or gun, to
154 be hereafter described. These bundles were steeped in water for a longer or shorter time, according to the state of the bamboo when cut. The soaked bundles of bamboo were next placed in a strong, wrought-iron tube or gun, capable of resisting considerable pressure, the gun being provided with a movable cap or head at one of its ends. When a sufficient number of the bundles of bamboo were placed inside the gun, its cap was adjusted steam-tight, and steam admitted at a pressure said to be of about a hundred and eighty pounds. The length of time the bamboo was exposed to the steam inside the gun depended on its condition when cut. If cut green, ten minutes was deemed sufficient; if cut dry, twenty-five minutes exposure was necessary, When the bamboo had been exposed for a sufficient time to the necessary steam-pressure, the cap was suddenly opened, and the bamboo blown from the gun by the force of the contained steam, which shivered and split it into a dark, stringy, fibrous mass, a small quantity of the intercellular matter being separated as a brown powder. The general effect of this operation was to reduce the bamboo into strings or tendrils.

Q. 7. If you say that you saw the prepared cane or bamboo, either or both, treated chemically, describe such treatment, and state particularly what you observed with respect to the following matters: If a boiler was used, what were its dimensions, and of what material was it constructed; whether it was set horizontal or upright; what its openings were, how they were closed, and in what manner heat was applied to them; and to what degree of temperature or pressure the contents were raised; how long the heat was applied, and the contents of the boiler retained before being discharged; and state, also, if you can, what degree of pressure the boilers were made capable of withstanding.

A. The chemical treatment of the bamboo was as follows: The rough

fibre as blown from the gun was passed through an ordinary straw-cutter previous to its being steeped in water or a waste alkaline solution, the product of a process to be hereafter described. The effect of the alkaline treatment, when adapted, was to partially pulp the
155 fibrous mass as blown from the gun. After draining, this rough pulp was placed in a boiler and subjected to the action of a caustic alkaline solution, at a steam pressure, said by Mr. Townsend to be of sixty pounds. The material is kept in the boiler for about six hours, when it was blown out, while under pressure, into a tank below the boiler. The result of this boiling and blowing out was the production of a pulp adapted for the manufacture of paper. The boilers used by this company are oblong in form, and are perhaps sixteen feet high by seven to eight feet in diameter, placed vertically. They are made of iron, and are provided at the top with a charging man-hole, and a perforated diaphragm to keep the contents submerged, and a blow-off valve at the bottom, by means of which the contents of the boilers are discharged, this discharge being effected while the boilers are under pressure. This pressure was said to be sixty pounds, and kept up from four to six hours. The mode of heating the boilers was by a system of steam-pipes inside the boilers, the steam necessary for heating the pulp-boilers being generated in a separate set of boilers. The pulping-boilers were provided with steam-gauges and safety-valves. I am unable to state with certainty the amount of pressure the boilers were capable of withstanding, but they seemed to be strong, well-made boilers, and capable of resisting considerable pressure.

Q. 8. If any alkaline solution or chemical preparation was put into the boiler before or during the application of heat, describe how that solution or preparation was made, its component parts, their relative proportions, the chemical strength of each, and the properties of the solution or preparation.

A. The alkaline solution used in the boilers described in answer to interrogatory seven was made by causticizing soda-ash by means of lime. I did not see the apparatus for making caustic soda, but, from Mr. Townsend informing me that equal parts of lime and soda-ash were used, I concluded that they made the caustic soda on the premises. I think I also understood him to say that they used the commercial caustic soda. From the quantities of the materials used, given me by Mr. Townsend, I found that each gallon of the alkaline solution would contain 0.68 of a pound of soda-ash, which, when causticized, is
156 equivalent to 0.33 of a pound of caustic soda. Of this solution two thousand five hundred gallons were used in charging a pulping-boiler capable of yielding three thousand pounds of dry pulp. The property of such caustic alkaline solution is such that, when, at a proper temperature and in sufficient quantity, it is brought in contact with vegetable substances containing intercellular matter, such intercellular matter is removed, the true fibre being left intact, unless great excess of alkali at a high temperature be employed, when the fibre itself will be attacked.

Q. 9. If you state that any alkaline solution or chemical preparation is used, state also its strength according to the standard hydrometer.

A. Taking the quantities and proportions as given me by Mr. Townsend, the strength of the caustic alkaline solution is about 8 Baumé.

Q. 10. Describe the condition in which the cane or bamboo is found after having been subjected to the processes you have mentioned, when the heat is withdrawn and the boilers are opened and their contents discharged.

A. The product obtained from the bamboo by the above-named process was in form of a brown pul[illegible].

Q. 11. Describe in what manner the chemical agents are removed from the other contents of the boilers, and also what is left after they are removed.

A. The pulp and alkaline solution are blown from the boiler into a tank provided with a false bottom, where the waste alkaline solution is allowed to drain off. (This waste alkaline solution is sometimes used in steeping the fibrous mass blown from the gun, as before described.) The drained pulp is removed to a rotary washer, and the remainder of the alkaline solution washed out. The pulp of a brown color remaining, as a residue, is well adapted for the manufacture of brown wrapping-paper. I did not see any of the pulp being bleached.

Q. 12. If you say that what is left is a material which may be used in the manufacture of paper-pulp or of paper, describe how it is thus used, and, if you have any samples of the same, please furnish a portion of them to the commissioner.

A. The brown pulp referred to in last interrogatory, after being
157 washed in a rotary washer, was taken to the ordinary rag-engine, there beaten and washed in the usual way, then passed through a Jordan-engine to finish it for the paper-machine, on which the paper is made. These processes being those ordinarily used in the manufacture of paper from rags. (Samples of pulp in various stages are handed the commissioner, and are marked by him, respectively, Exhibits A. H. S., Nos. 1, 2, 3, and 4, are annexed hereto.) Exhibit No. 1 being bamboo blown from the gun; No. 2, bamboo blown from gun and boiled in caustic alkali, at a pressure said to be of sixty pounds, and blown from pulping boiler; No. 3, bamboo pulp prepared, as described in No. 2, and subjected to beating-engine; No. 4, bamboo-pulp prepared, as described in No. 2, and passed through "Jordan-engine" subsequent to being subjected to beating-engine and ready for the paper-machine.

Q. 13. Have these defendants, to your knowledge, been successful in the manufacture of paper-pulp or of paper from cane or bamboo?

A. I believe that the defendants have been successful in the manufacture of a brown wrapping-paper from cane and bamboo. I was told that some quantity of the bamboo-pulp had been bleached and converted into white paper.

Q. 14. Please annex to your deposition any samples of paper manufactured by the defendants; and state if you know the proportions of the several ingredients of such paper.

A. Annexed are samples of papers, said to be all bamboo, and bamboo and flax. The proportions of the materials in the papers were given me by Mr. Towsend and were as follows: C, all bamboo, unbleached; F, all bamboo, bleached; G, four-fifths of bamboo, one-fifth flax, bleached. I also annex two samples of bamboo-pulp, which I have marked Nos. 1 and 2.

(The five samples aforesaid are fastened together by the commissioner, and are annexed hereto, marked A. H. S., No. 5.)

Q. 15. State what knowledge and experience you have had in the manufacture of paper from wood, straw, and other materials.

158 A. I have been engaged in the preparation of paper-pulp from straw and other vegetable substances since the year 1851. I have been engaged in the manufacture of paper from such pulp since 1856.

Q. 16. Have you examined re-issued patents, numbered 1448 and

1449; and do you understand the inventions therein described and claimed?

A. I have carefully and well examined re-issued patents numbered 1448 and 1449, and perfectly understand the inventions therein described and claimed.

Q. 17. State whether the samples of pulp exhibited by you, and referred to in the answer to interrogatory No. 12, are substantially the same as the pulp described in the re-issued patent numbered 1448, and are produced by substantially the same process as that described in re-issued patent, numbered 1449.

A. The samples of pulp exhibited, and referred to in answer to interrogatory 12, are substantially in the same condition and of the same character as pulp produced by the re-issued patent 1448, and are produced substantially by the same process as that described in re-issued patent No. 1449.

Q. 18. Have you examined the patents issued to Morris L. Keen, bearing date September 13, 1859, and June 16, 1863, for improvements in boilers for making paper-pulp from wood, and do you understand the invention therein described and claimed?

A. I have examined the patents issued to M. L. Keen, bearing date September 13th, 1859, and June 16, 1863, for improvements in boilers for making paper-pulp from wood and other vegetable substances, and fully understand the invention therein described and claimed.

Q. 19. State whether the boilers used in the factory of the defendants are or not substantially the same as those described and patented by said Keen, and are heated and operated in substantially the same way.

A. The boilers used in the factory of the defendants are substantially the same as those described and patented by said Keen, and are operated and heated substantially in the same way.

159 Q. 20. Are you the person named in the patent granted to Charles Watt and Hugh Burgess, in England, dated August 19, 1853?

A. I am.

Q. 21. State when the invention described in the specifications attached to said patent was made, and under what circumstances.

A. I commenced to make experiments on the preparation of pulp for paper-making purposes from wood, &c., in the year 1851, with Mr. Charles Watt; on account of his great age, most of the experiments devolved on myself.

Q. 22. Describe the first experiments made to carry the invention into effect, and their result.

A. My first experiments were carried out on a small scale. At this time I had no laboratory of my own, and was much limited as to apparatus, and was compelled to work with such apparatus as I could find in my friends' laboratories; such apparatus as I could not procure in one place I would seek in another. Vessels used for boiling wood in alkalies, under and without pressure, were of the ordinary kind used in a laboratory, such as small iron-boilers, glass-flasks, and iron enamelled ware. I generated the chlorine and hypochlorous acid in the usual apparatus, making large glass-vessels answer the purpose of gasing and bleaching-chambers. I worked until I ascertained the nature of the intercellular tissue of wood, what means would effect its destruction and leave the fibre intact, and also what was the proportion of this fibre. The decomposition of the intercel-

lular tissue was effected by several methods. Chromic and permanganic acids, and one or two compound processes were used, and pulp was produced. The effect of caustic alkaline solutions was examined into as well as chlorine in a liquid and gaseous form. I made a great many experiments in boiling wood in caustic-alkaline solutions. My knowledge of chemical re-actions taught me the great advantage afforded by increase of temperature in effecting chemical decompositions, and the idea of boiling under pressure occurred to me. I produced a good pulp by boiling wood in caustic alkali at a high pressure. I found that some woods required much more alkali than others. I found that when intercellular matter was not wholly removed by caustic alkali, it could be decomposed by chlorine or
160 the hypochlorides, one answering the purpose as well as the other. I used, therefore, chlorine or bleach-powder, preferably chlorine, since one of the products attending the elimination of chlorine, namely, sulphate of soda, had a marketable value in England. I found that to a certain extent, and when desirable, I could substitute the employment of caustic alkali for chlorine, the one for the other, but the nature of the wood under treatment materially affected this substitution. I found the greater quantity of intercellular tissue wae removed by the caustic-alkali, the less chlorine or its compounds with oxygen was required, and consequently the higher the temperature and pressure, and the greater the strength of the alkali employed, the less of the intercellular tissue was left, and consequently less chlorine or its compounds with oxygen required; but if sufficient caustic alkali was employed at a requisite temperature, chlorine was only necessary for bleaching purposes. As regards the cost, the chlorine process appeared to cost less than the free use of alkali, since one of the products of its elimination is a marketable article in England, and we calculated on the sale of the sulphate of soda as one of the sources of profit in working the patent. In drawing up the specification for a patent, I therefore laid most stress on the process that seemed to offer the greatest pecuniary advantage, since the recovery of the soda-ash had not been practically tried by us at this time, and we were in uncertainty as to the success of such recovery. With a knowledge of the above facts, I was desirous of embracing in my specification the modes of producing wood-pulps with caustic-alkali, either with or without steam-pressure; supplementing, when necessary, the alkaline boiling, with the subsequent treatment of chlorine or the hypochlorides. In my rough draft of specification, drawn up in 1852, I described the use of boiling under either high or low pressure, in the following words:

The shavings should then be boiled in caustic alkali of a strength indicated by about twelve of the English hygrometre. This process is much better performed under high pressure, after the wood has been boiled for about twenty-four hours, but we do not confine our-
161 selves to this time, as it varies with the nature of the wood and the amount of pressure.

I used the words "and amount of pressure," purposely to express that I did not confine myself to any definite amount of pressure, as I was aware that I could increase the chemical effect of the alkaline solution in its action on wood by increasing temperature, or, in other words, the pressure.

Q. 23. State who prepared the specification of the English patent.

A. I prepared the specifications, both provisional and final, of the English patent.

Q. 24. State whether you prepared a description of your invention prior to your application for a patent; and if so, and the same is in your possession, produce it, and annex a copy to your deposition.

A. I prepared a rough draft of a specification previous to my application for a patent. I have the same in my possession. This was prepared previous to the specification of the English patent, 1853. This is the rough draft I now produce. This paper which I now produce is a photographic copy of that part of the original rough draft above mentioned which refers to boiling at a high temperature.

(The draft referred to by the witness is marked by the commissioner A. H. S., No. 6; the photographic copy referred to by him is annexed hereto, and is marked by the commissioner A. H. S., No. 7.)

Q. 25. State whether any portions of this description were modified in the specification attached to the patent, and why.

A. After preparing the rough draft of specification, I was impressed with the idea that I should invalidate our patent if I broadly claimed pressure-boiling as part of my invention, as I was aware that the process of boiling under pressure, as a process, was not new. I had also ascertained that a process existed for boiling rope and rags under pressure, though at too low a temperature to pulp wood. I had never heard of the process of boiling under pressure being used to pulp vegetable substances. In the specification finally decided on, I disclaimed the process of pressure-boiling as a process, as my invention, but I believe I had so expressed myself as to claim as our process the boiling
162 wood in caustic alkaline solutions, both under or without pressure; the amount of pressure to be used by the subsequent chemical treatment of the boiled wood or pulp, as the nature of the wood should determine. At this time I was not aware that any previous attempt had been made to produce a pulp from wood, and was ignorant that any previous process for pulping wood by boiling in alkaline solutions, under pressure, existed.

Q. 26. State whether or not you were governed by the reasons stated in answer to the last interrogatory in preparing your specification as annexed to the letters-patent granted in the United States.

A. In preparing the American specifications I had no reason to alter the general wording of the specification of the English patent, as I believed it covered all the practical modes of making wood-pulp that I was acquainted with, and I was not aware that sulphurate of soda, the product of the elimination of chlorine, was of little or no value in this market, or that manganese, used in the production of chlorine, was so expensive in this country.

Q. 27. State when you came to this country, and for what purpose.

A. Soon after the English patent was granted, a proposition was made to me by Mr. F. B. Houghton to work the patent in the United States. On the preliminaries being arranged I left England for that purpose, and arrived in New York in the beginning of February, 1854. As soon as I could learn there was a probability of my obtaining the Watt and Burgess patent in this country, I proceeded, in conjunction with M. L. Keen to look for a site on which to put up small works, and the necessary apparatus was ordered.

Q. 28. State what you did about procuring the necessary apparatus for working your invention, and what was ordered by you for that purpose.

A. I advised Mr. Keen as to the kind of apparatus we should require to carry out the process described in the Watt and Burgess patent. This apparatus consisted of a rotary boiler capable of resisting conside-

rable pressure, for the purpose of boiling the wood in caustic alkali,
by means of steam-pressure, alkali-mixing apparatus, gasing-
163 boxes, and washing and bleaching apparatus for the purpose of
washing and bleaching the pulp.

Q. 29. Was that before or after your application for a patent in this country?

A. The apparatus referred to in the answer to the preceding interrogatory was ordered after the application for the United States patent, but previous to its being granted. We had most of the apparatus in place at the time of the issuing of the patent. The pressure-boiler was, I believe, ordered in June, 1854.

Q. 30. State when the apparatus was procured; and if so, state when and where it was put in operation.

A. The pressure-boiler for boiling the wood in caustic alkali was made by Joseph Aymer & Co., of West Philadelphia, in June, 1854. The remainder of the apparatus being mostly made of wood and brick work, was put up by our own carpenters and mechanics. The apparatus was put in operation at Gray's Ferry, August, 1854.

Q. 31. State whether you then used caustic alkali, under pressure created by heat, for the purpose of producing pulp from wood.

A. We boiled wood in caustic alkali, under high pressure and temperature, and produced wood-pulp by this means, in the summer of 1854.

Q. 32. Did you make any memoranda, at the time, of the mode of working your process? If so, state how, and when, and within what periods they were made, and for what purpose.

A. I kept a journal of the results of our working at Gray's Ferry. The first entry was made August 20th, 1854. I kept this journal for about five months, till we ceased operations at Gray's Ferry. I kept it for the purpose of noting the quantity of materials used, the results of the process and the quality of the pulp produced.

Q. 33. Produce such memoranda, and annex copies of the same to your deposition, with such explanations as will make them intelligible.

A. I here produce my original journal, (marked by the commissioner, Exhibit A. H. S., No. 8,) and also photographic copies of such parts of
it as relate to the manufacture of pulp from wood.
164 (These photographic copies are marked by the commissioner
Exhibits A. H. S., 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, and are annexed hereto.)

On Exhibit 9, experiment *f*, the entry of one pound of sawdust boiled to a pulp, &c., was made in order to prove the loss that would accrue to such pulp by bleaching. This loss, arising from the handling and the bleaching, was 9.40 per cent., which proves that, in August, 1854, we produced a nearly pure pulp by boiling in caustic alkali, under pressure. The entry H, on Exhibit 10, proves that by boiling wood in caustic alkali under pressure we obtain 34 per cent. of pulp. This yield is a proof of the purity of the pulp so obtained, as ordinary wood only contains from 30 to 38 per cent. of pure cellulose or fibre. On same exhibit there are also some small experiments relative to the recovery of soda-ash. Exhibit 11 refers to the production of a fair pulp by boiling wood in caustic alkali, under pressure. Exhibit 12 refers to wood softened but not pulped from the want of causticity of the alkali. I would here remark that our apparatus for making caustic alkali was very inferior, being only made of wood. Exhibit 13 refers to a boiling failing for want of steam-pressure, the steam-pipe having burst. Exhibit 14 refers to the fact that the wood was not pulped by an expermental

boiling when soda-ash and lime were mixed in the boiler together. Exhibit 15 demonstrates that when we failed to produce pulp by means of boiling under pressure in caustic alkali, we were accustomed to reboil with fresh caustic alkali, if necessary, till the pulping was produced. This exhibit also refers to our mode of blowing out our boiler while under pressure. Exhibit 16 again demonstrates our customary method of reboiling when the wood was not sufficiently pulped. Exhibit 17 proves the production of a wood-pulp by boiling wood in caustic alkali, under pressure. Exhibit 18 demonstrates our mode of reboiling till pulping was obtained by boiling in caustic soda, under pressure. Exhibit 19 demonstrates that the wood was not pulped, owing to the alkali being neutralized in that boiling. These notes relative to the above boilings were made when any failure or accident, or when any particular quantity of materials was made use of that I wished to note. These memoranda do not at all represent all the boilings made, which were usually at the rate of one a day for some months.

165 Q. 34. State whether you succeeded in the manufacture of paper-pulp from wood, and what was done with the pulp so made?

A. The manufacture of pulp from wood by the process as recorded in my journal was a success. Some of the pulp made at Gray's Ferry was sent to Mr. Warren's paper-mill, at Maylandville, some to Messrs. Magarge Bros., and some to Mr. Howard Lewis.

Q. 35. State where the manufacture has been carried on since 1854, and to what extent?

A. After the manufacture at Gray's Ferry was considered a success, larger works were put up at Royer's Ford, the capacity of these works being from two to three tons a day. These works are still in operation, and are now being increased to five or six tons a day. We commenced work at Royer's Ford in 1856; in 1866 works were put in operation at Manayunk capable of turning out from twelve to fourteen tons a day.

Q. 36. State whether the process used has been substantially the same throughout?

A. The process of manufacturing pulp from wood now carried on is substantially the same as that carried on at Gray's Ferry, where Watt and Burgess' patent was first operated. We used the hypochlorites or bleach-powder in place of chlorine. The recovery of soda-ash has been improved on, enabling us to use a larger quantity of this material, and, consequently, allowing us to dispense with the use of a certain proportion of chlorine or bleach-powder. At the present time we occasionally use the double process described in the Watt and Burgess patent, when we are working on old, highly resinous woods; that is to say, that after the wood has been boiled to a pulp by means of caustic alkali, at a high temperature, it is treated with hypochlorites in solution, again treated with alkali and bleached.

Q. 37. What is the usual time required at Royer's Ford for boiling the wood to a pulp?

A. The boiler is filled and discharged on an average before the five hours.

Q. 38. When did you first begin to discharge the contents of the boiler under pressure, and at what place?

166 A. About December, 1854, at Gray's Ferry.

Q. 39. Where were the entries made in the journal produced by you, and what marks thereon were made since the original entries, if any, and when?

A. The notes in my journal were entered on the day the various boilings, &c., were made. Pencil-marks were made under some of the

original entries at the time my journal and papers were submitted to Mr. Jenckes, at the time of the formation of the America Wood-Paper Company.

Q. 40. Do you know, or can you set forth any other matter or thing which may be a benefit or advantage to the parties at issue in this cause, or either of them, or that may be material to the subject of this your examination, or the matters in question in this cause? If yea, set forth the same fully and at large in your answer.

A. In the year 1858, Mr. Mallery, who at that time I believed controlled the Lyman patent, made a visit to Royer's Ford, with the view, I believe, of ascertaining whether we were inclined to make an arrangement for the working of the Lyman patent. We showed Mr. Mallery the effect of boiling in caustic alkali, under pressure, bamboo disintegrated by blowing from the gun. We also showed him that though the blown-bamboo could be pulped by means of caustic alkali, with mechanical aid without pressure, yet this pulp could not be bleached without great difficulty, unless it was boiled in caustic alkali, under a certain amount of pressure. Mr. Mallery appeared, up to this time, quite ignorant of the effects of boiling in caustic alkali, under pressure, and was surprised at the results of such boiling. He took some of the solution of caustic soda away with him. He also saw the mode of discharging the boiler while under pressure, which is one of the principal features of the Keen patent.

The counsel for the plaintiff now closes his examination-in-chief of the witness Hugh Burgess.

Examination adjourned to the 30th January, 1867, at 11 a. m.

167 OFFICE OF THE EXAMINER,
137 SOUTH FIFTH STREET, PHILADELPHIA,
January 30, 1867—11 *a. m.*

Present, Mr. Wallace, for the plaintiffs, and Hugh Burgess, the witness under examination.

The counsel for the defendants not being present, the examination is adjourned to the 1st February, 1867, at 11 o'clock a. m.

OFFICE OF THE EXAMINER,
137 SOUTH FIFTH STREET, PHILADELPHIA,
February 1st, 1867—11 *a. m.*

Present, Mr. Wallace, for the plaintiff, and Hugh Burgess, the witness under examination.

The counsel for the defendants not being present, the examination is adjourned at the request of Mr. Wallace, till Wednesday, February 6, 1867, 11 a. m.

OFFICE OF THE EXAMINER,
137 SOUTH FIFTH STREET, PHILADELPHIA,
February 6th, 1867—11 *a. m.*

Present, Mr. Wallace, for plaintiff, and Hugh Burgess, the witness under examination.

The counsel for the defendant not being in attendance, the examination is adjourned, at the request of Mr. Wallace, to Friday, the 8th February, 1867, at 11 a. m., and notice thereof is given in writing by the examiner to Mr. Harding.

168 OFFICE OF THE EXAMINER,
137 SOUTH FIFTH STREET, PHILADELPHIA,
February 8th, 1867—11 *a. m.*

Present, Mr. Wallace, for the plaintiffs. Hugh Burgess, the witness

under examination at the former meetings, was again in attendance, but the counsel for the defendants not being present the examiner proceeded to the examination of B. Howard Rand, one of the witnesses named in the said first-mentioned order of court, who, being duly sworn, deposeth and saith as follows:

Q. 1. What is your name, age, residence, and occupation?

A. B. Howard Rand, M. D.; age thirty-nine years; residence 1615 Summer street, Philadelphia.

Q. 2. State what experience you have had in chemistry as applied to the arts, and what knowledge you have of its special application to the manufacture of paper-pulp and of paper.

A. I have been teaching chemistry since 1853, and have made myself acquainted, from time to time, with its application to the arts. My knowledge of its special application to the manufacture of paper-pulp and paper has been derived from observations and experiments made during the past year.

Q. 5. Have you examined the re-issued patents, numbered 1448 and 1449; and if so, will you state whether you understand the invention therein described and patented?

A. I have examined said patents, and understand the invention therein described and patented.

Q. 4. State whether or not the language of the specifications describes in full, clear, and exact terms the process of manufacturing paper-pulp from wood and other vegetable substances, so as to enable yourself or any person skilled in the art of paper-making, to manufacture the same.

A. It does.

Q. 5. What, in your opinion, are the characteristics of the invention described in these specifications?

A. The characteristics of the invention referred to are boiling
169 wood, straw, or other vegetable substances in a solution of caustic alkali, at a temperature at, near, or above 300° F.; and, when necessary, the use of chlorine or its compounds with oxygen, for the purpose of obtaining white pulp adapted to paper-making. It is strictly a chemical process.

Q. 6. Have you examined the patents granted to M. A. C. Mellier, dated May 26, 1857, antedated to August 7, 1854; and, if so, do you understand the same, and the invention therein described?

A. I have examined said patents, and understand the invention therein described.

Q. 7. State what knowledge you have of the processes used by the defendants, the Fibre-Disintegrating Company, in the manufacture of paper-pulp and paper from wood, straw, and other vegetable substances.

A. My knowledge of the processes used by the defendants is derived from the defendants' answer, and from the report of Mr. Hugh Burgess, from his testimony in this case, and the testimony of Mr. John McCracken, in this case.

Q. 8. State whether or not, in your opinion, the processes used by the defendants are substantially the same as those described and patented by the persons and in the patents above referred to; and give your reasons in full for your opinion.

A. I believe that the processes used by the defendants in this suit are substantially the same as those described in the patents referred to. My reasons for this opinion are as follows: The defendants in their answer state that they boil the blown-cane in caustic alkali, at a pres-

sure of from twenty to forty-five pounds, which they further state corresponds to a temperature of 234° to 275° F. They claim the right to use any temperature. By actual experiment I have found that a pressure of forty-four pounds per square inch above atmospheric pressure, (this being the universal meaning of the term steam-pressure in this country,) with caustic alkali at 5° Baumé and vegetable matter in proper proportion to said alkali for pulping purposes, corresponds to a temperature of 296° F.; with distilled water this pressure cor-
170 responds to 294° F. The temperature claimed in the re-issued patents, Nos. 1448 and 1449, is at, near, or above 300° F. The statement of the defendants in regard to the temperature is erroneous; and they refer in their answer to the table of steam-pressures of the French Academy as authority. This table is recognized as such throughout the scientific world, but the defendants have overlooked the important fact that it starts from a vacuum as 0, and makes ordinary atmospheric pressure 14.7 pounds, whereas safety-valves and manometer-gauge in this country are always graduated so as to express the pressure in pounds above that of the atmosphere. Thus 14.7 pounds of the French gauge is 0. of the ordinary steam-gauge; 45 pounds steam-pressure corresponds, therefore, to 59.7 pounds of the French Academy, or as before 294° F. Mr. John McCracken, in his testimony in this case, states that the blown-bamboo was boiled by the defendants under a pressure, with alkali, of from forty to sixty pounds to the square inch. This would give a temperature with water alone of from 289° F. to 311° F., and with caustic alkali at 5° B. and vegetable matter in the proper proportion for pulping of 295° F. to 313° F., which temperatures are "at, near, or above 300° F." The only feature in the defendants' process which is essentially different from that of the re-issued patents, Nos. 1448 and 1449, is the preliminary "blowing" with the steam-gun under the Lyman patent. I am of the opinion that this operation is almost entirely mechanical, and is chiefly a division of the bamboo preliminary to the subsequent chemical operations, which are essentially the same as those described in the specifications named above. That a small quantity of loose silicious and intercellular matter is detached, I admit; it is found in the blown-cane as a sort of dust or powder; but both chemical and microscopical examinations show that the quantity of extraneous matter removed is too small to be of any practical value, and that white paper cannot be made by the usual process of this blown-bamboo, unless it be previously boiled in alkali at a temperature near or above 300° F.

171 Q. 9. Have you examined the patents granted to Morris L. Keen, dated September 13, 1859, and May 18, 1863, for improvements in boilers for making paper-pulp from wood, and state whether you understand the same; and, if so, state the characteristics of the invention therein described and claimed.

A. I have examined said patent and understand the same. The characteristics are, first, the patent stirrers; second, the expansion chamber with a strainer, the object of which is to keep the wood immersed in the alkaline solution and yet allow the expansion of the liquor under the influence of an increase of temperature; third, a discharge cock or valve, at or near the bottom of the boiler, by means of which the pulp may be gradually blown out under steam-pressure, for the purpose of opening out masses of wood, straw, or other vegetable substances previously disintegrated by chemical means.

Q. 10. State what knowledge you have of the boilers used by the defendants in this suit.

A. My knowledge of the boilers used by the defendants is derived from the testimony in this case of Mr. John McCracken, and of Mr. Hugh Burgess, as well as the defendants' answer.

Q. 11. State whether or not, in your opinion, the boilers used by the defendants are substantially the same in construction and mode of use and operation as those described and patented in the patents above referred to, and give your reasons for your opinion.

A. Mr. John McCracken states that the pulp "was blown out (of the alkaline boiler) into a tank, washed," &c. The pulp could only be blown out of a boiler by having an opening at or near the bottom of the boiler, furnished with a valve or its equivalent, substantially the same as in Keen's patent. Mr. Burgess says, "The boilers are provided with a charging man-hole and a perforated diaphragm, to keep the contents submerged, and a blow-off valve at the bottom, by means of which the contents are discharged." The perforated diaphragm and valve at the bottom for the discharge of the contents of the boiler are characteristic of Keen's patent.

Q. 12. State what, in your opinion, is necessary and requisite
172 for the manufacture of paper-pulp and paper from wood-straw, and other vegetable substances; and also state what the component and constituent parts of that fibre are known to be; and also what component or constituent parts of the wood, straw, and other vegetable substances should be removed or destroyed.

A. Fibres which are flexible, thoroughly detached from each other, pliable and capable of felting or matting. Cellulose possesses these properties. It consists of carbon, hydrogen, and oxygen. Wood, straw, and other vegetable matters contain, besides cellulose, intercellulose, which has a different physical and chemical constitution. It is injurious, and should be removed. The finer the cellulose produced from wood, straw, &c., the more easily is such cellulose converted into paper, and the better is the quality of the resulting paper.

Q. 13. State whether or not the requisite fibre can be obtained and the foreign or injurious substance removed by chemical agency, and whether or not they can be obtained or removed by any other agency, and give your reasons for your opinion.

A. The requisite fibre can be obtained and the foreign and injurious substances removed by chemical agency. The latter cannot be removed by mechanical agency, because they are too intimately attached to the true fibre. By the blowing process a small portion of the silicious and other foreign matters of bamboo are removed; but a fibre suitable for making white paper cannot be thus procured. A subsequent chemical treatment is necessary to destroy the remaining portion of the intercellulose.

Q. 14. State and describe, if you know, what is "pure cellulose," and how obtained, and where?

A. Pure cellulose is the true fibre or tubular structure of wood. It is wholly and freely soluble in sulphuric acid, without browning or blackening. Its solution in sulphuric acid is clear and colorless. It is best obtained by boiling vegetable substances in caustic alkali, under a high pressure and a corresponding temperature, say 160 pounds steam-gauge, corresponding to about 380° F. Cellulose exists nearly pure in cotton and bleached linen fibre.

Q. 15. State whether or not pure cellulose can be procured or
173 obtained from wood, straw, or other vegetable substances by other than chemical agencies, and give your reasons for your opinion.

A. Pure cellulose can be obtained only by chemical means. The cellulose and intercellulose are so intimately united that no known mechanical means can wholly separate them.

Q. 16. Suppose that the defendants used the following mode of operation with wood: "The bamboo and other vegetable fibres, but almost exclusively bamboo, in lengths of about five feet, split lengthwise into two or three pieces, is put into a steam-cylinder called a gun, and, after being therein subjected for about fifteen minutes to a steam-pressure of about 170 pounds, is projected from such cylinder into the atmosphere by the force of the steam in such cylinder. The fibres of the bamboo are thus disintegrated and the principal part of the gum, silex, and other useless matters can be washed out by the application of water. This steam-boiling process is used by the said defendants under the patent granted by the United States to Azel S. Lyman, of New York, on 3d August, 1858, and which patent has been duly assigned to these defendants. The steam-blown bamboo and other vegetable fibres are then put in a paper-maker's beating-engine, and there for a short time beaten and washed. It is now pulp, fit for coarse paper. Caustic alkali is then put to the pulp and it is boiled under a pressure of about 20 to 45 pounds, being a heat of about 234 to 275 degrees Fahrenheit's scale. A lower pressure will answer very well; but a little advantage may be gained by the higher pressure, and these defendants claim the right to boil said pulp under any pressure. In some cases the pulp, after being boiled as aforesaid, is more thoroughly disintegrated by being subjected to the blowing process a second time, that is to say, the contents of the boiler are blown directly and with great force into a tank by the pressure of the steam in the boiler; but in some cases the defendants use a Spofford rotary boiler, and this last-mentioned blowing process is then omitted. Nor is it absolutely essential after blowing from the guns and the preliminary pulping process before referred to. The pulp after being boiled is washed and made into paper in the usual way, being
174 bleached in the usual way, when white paper is required." In your opinion, is the process thus described substantially the same as that described and claimed in the complainants' patents, and give your reasons for your opinion.

A. The answer to this interrogatory is contained in that to interrogatories Nos. 8 and 11.

Q. 17. State whether the article produced by what is called in the extract embraced in the previous interrogatory "the steam-blowing process," is paper-pulp or not; and describe what you understand by the phrase "paper-pulp."

A. The substance produced by the steam-blowing process" is not paper pulp; it is merely bamboo, mechanically disintegrated, with the loss of a small per cent. of injurious matter, and cannot be made into paper without subsequent chemical treatment. Even after the alkaline treatment in the open tank, it can only be made into brown paper. To make it into white paper would require an excess of the hypochlorites, as set forth in the specification of the Coupier and Mellier patent. It is not affected by 35 per cent. of bleach-powder, the usual process requiring from 10 to 15 per cent. for bleaching. I should define paper-pulp as a material capable of being made into white paper of fair quality after bleaching by the usual process, without a large admixture of other paper-making material.

Q. 18. Look at the samples of the defendants' manufacture, produced by Hugh Burgess, and annexed to his deposition in this cause, and state whether or not they are substantially the same articles as that described and claimed in re-issued patent 1448, and give your reasons for your opinion.

A. They are substantially the same, being material suitable for the

manufacture of paper made from bamboo, a species of wood, by boiling in caustic alkali at a temperature "at, near, or above 300° F."

Q. 19. Have you examined and are you familiar with the patent granted to Hector Campbell, by the English government, November 28, 1792, No. 1922? and if so, state whether such patent is for the same or substantially the same process as that described and claimed in re-issued patent No. 1449, (the Watt and Burgess patent,) and whether the article produced is the same or substantially the same as that described
175 in re-issued patent No. 1448, for a new manufacture; and if not, state why not; and state fully wherein the re-issued patent differs from the above-mentioned patent of Hector Campbell, and in what respects they are for distinct and separate inventions.

A. I have examined and am familiar with said patent. It differs from the re-issued patents Nos. 1448 and 1449. The patentee treats rags, cotton, and hemp, &c., by boiling in caustic alkali, and then bleaches by chlorine. He does not refer to wood or straw. He does not boil under pressure.

Q. 20. Have you examined and are you familiar with the patent granted to William Cunningham, by the English government, November 28, 1794, No. 2026? and if so, state whether such patent is for the same or substantially the same process as that described and claimed in re-issued patent No. 1449, (the Watt and Burgess patent,) and whether the article produced is the same or substantially the same as that described in re-issued patent No. 1448, for a new manufacture; and if not, state why not; and state fully wherein the re-issued patent differs from the above-mentioned patent of William Cunningham, and in what respects they are for distinct and separate inventions.

A. I have examined said patent and am familiar with it. It differs from the re-issued patents Nos. 1448 and 1449. The patentee boils rags in weak caustic alkali, and then submits them to the action of gaseous chlorine, the process being repeated when necessary. The chlorine is derived from chloride of sodium or chloride of calcium, the patentee supposing that there is a difference in the gas evolved from these two compounds. He does not refer to wood or straw. He does not boil under pressure.

Q. 21. Have you examined and are you familiar with the patent granted to John Trumbull, jr., by the English government, November 15, 1800, No. 2449? and if so, state whether such patent was for the same or substantially the same process as that described and claimed in re-issued patent No. 1449, (the Watt and Burgess patent,) and whether the article produced is the same or substantially the same as that
176 described in re-issued patent No. 1448, for a new manufacture; and if not, state why not; and state fully wherein the re-issued patent differs from the above-mentioned patent of John Trumbull, jr., and in what respect they are for distinct and separate inventions.

A. I have examined said patent and am familiar with it. The patent refers to the bleaching of fabrics only, not to paper-making. The goods after washing are steeped in caustic or carbonated potassa, soda, or ammonia, with or without chlorine, or lime or soap. They are then drained or steamed in vessels of wood, stone, brick, earthenware or metal. These "vats" communicate with a boiler by means of a pipe or hose, which may be made of wood. The patentee claims to work under pressure, but it is obvious that no considerable pressure could be used in such vessels. The patentee does not use a temperature approaching 300° F. He does not refer to wood or straw. He does not refer to the manufacture of paper-pulp.

Q. 22. Have you examined and are you familiar with the patent granted to Matthias Koops, by the English government, February 17, 1801, No. 2481? and if so, state whether such patent is for the same or substantially the same process as that described and claimed in re-issued patent No. 1459, (the Watt and Burgess patent,) and whether the article produced is the same or substantially the same as that described in re-issued patent No. 1448, for a new manufacture; and if not, state why not; and state fully wherein the re-issued patent differs from the above-mentioned patent of Matthias Koops, and in what respects they are for distinct and separate inventions.

A. I have examined said patent and am familiar with it. It differs from the re-issued patents Nos. 1448 and 1449. The patentee refers to the use of straw or hay, the wood of the willow or aspen, and the refuse of hemp and flax. He boils in lime-water, without pressure. The only reference made to caustic alkali is where, in the treatment of hemp or flax, he adds to his lime-bath for soaking, six pounds of potash or "crystal carbonate of soda," and the same amount when boiling to 270 gallons of water. This quantity of caustic alkali would be inap-
177 preciable to the hydrometer. The patentee did not use pressure boiling. The patentee did not practically use caustic alkali.

Q. 23. Have you examined and are you familiar with the patent granted to James Vincent Desgrand, by the English government, May 18, 1838, No. 7643? and if so, state whether such patent is for the same or substantially the same process as that described and claimed in re-issued patent No. 1449, (the Watt and Burgess patent,) and whether the article produced is the same or substantially the same as that described in re-issued patent No. 1448, for a new manufacture; and if not, state why not; and state fully wherein the re-issued patent differs from the above-mentioned patent of James Vincent Desgrand, and in what respects they are for distinct and separate inventions.

A. I have examined said patent and am familiar with it. It differs from the re-issued patents Nos. 1448 and 1449. The patentee refers to wood, which he steeps in milk of lime, for three to six weeks, washes and beats to pieces. He does not use caustic alkali nor pressure-boiling.

Q. 24. Have you examined and are you familiar with the patent granted to George Robert D'Harcourt, by the English government, August 15, 1838, No. 7772? and if so, state whether such patent is for the same or substantially the same process as that described and claimed in re-issued patent No. 1449, (the Watt and Burgess patent,) and whether the article produced is the same or substantially the same as that described in re-issued patent No. 1448, for a new manufacture; and if not, state why not; and state fully wherein the re-issued patent differs from the above-mentioned of George Robert D'Harcourt, and in what respects they are for distinct and separate inventions.

A. I have examined said patent, and am familiar with it. The patentee uses various vegetable fibres, but does not mention wood. He macerates in water at 120° F., presses and exposes to the action of a lime-soap in a covered cauldron. He does not mention pressure, nor does he use caustic alkali.

Q. 25. Have you examined and are you familiar with the patent granted to Morton Balmanno, by the English government, September 6, 1838, No. 7794? and if so, state whether such patent is for the same or
178 substantially the same process as that described and claimed in re-issued patent No. 1449, (the Watt and Burgess patent,) and whether the article produced is the same or substantially the same as

that described in re-issued patent No. 1448, for a new manufacture; and if not, state why not; and state fully wherein the re-issued patent differs from the above-mentioned patent of Morton Balmanno, and in what respects they are for distinct and separate inventions.

A. I have examined said patent and am familiar with it. It differs from the re-issued patents Nos. 1448 and 1449. The patentee uses various vegetable fibrous subtances and the wood of osiers, roots, &c. He macerates and boils in caustic or carbonated alkali. The quantity of caustic alkali is stated at six pounds to the hundred weight of bark, a quantity entirely too small to effect disintegration. The material after boiling is beaten out into half-stuff in the engine. The patentee does not use pressure, nor does he disintegrate by chemical means.

Q. 26. Have you examined and are you familiar with the patent granted to Edward Cooper, by the English government, November 3, 1838, No. 7850? and if so, state whether such patent is for the same or substantially the same process as that described and claimed in re-issued patent No. 1449, (the Watt and Burgess patent,) and whether the article produced is the same or substantially the same as that described in re-issued patent No. 1448, for a new manufacture; and if not, state why not; and state fully wherein the re-issued patent differs from the above-mentioned patent of Edward Cooper, and in what respects they are for distinct and separate inventions.

A. I have examined said patent and am familiar with it. It differs from the re-issued patents Nos. 1448 and 1449. The patentee refers to the megasse of sugar-cane, which he macerates and beats in the rag-engine. He does not use any chemical process.

Q. 27. Have you examined and are you familiar with the patent granted to John Small, by the English government, December 1, 1838, No. 7883? and if so, state whether such patent is for the same or substantially the same process as that described and claimed in re-
179 issued patent No. 1449, (the Watt and Burgess patent,) and whether the article produced is the same or substantially the same as that described in re-issued patent No. 1448, for a new manufacture; and if not, why not; and state fully wherein the re-issued patent differs from the above-mentioned patent of John Small, and in what respects they are for distinct and separate inventions.

A. I have examined said patent and am familiar with it. It differs from the re-issued patents Nos. 1448 and 1449. The patentee claims the use of the fibres of the banana, plantain, aloe, fig, and palm tree, for making paper or cordage, but does not claim any process. He merely crushes between sugar-cane rollers and washes. He does not use any chemical process.

Q. 28. Have you examined and are you familiar with the patent granted to Miles Berry, by the English government, November 19, 1839, No. 8273? and if so, state whether such patent is for the same or substantially the same process as that described and claimed in re-issued patent No. 1449, (the Watt and Burgess patent,) and whether the article produced is the same or substantially the same as that described in re-issued patent No. 1448, for a new manufacture; and if not, state why not; and state fully wherein the re-issued patent differs from the above-mentioned patent of Miles Berry, and in what respects they are for distinct and separate inventions.

A. I have examined said patent and am familiar with it. It differs from the re-issued patents Nos. 1448 and 1449. This patent refers to the use of the esparto grass. The material is crushed and steeped in lime-water until it begins to ferment. It is then put into the rag-engine. The patentee does not use caustic alkali or pressure boiling.

Q. 29. Have you examined and are you familiar with the patent granted to Lemuel William Wright, by the English government, June 15, 1843, No. 9787? and if so, state whether such patent is for the same or substantially the same as that described and claimed in re-issued patents No. 1449, (the Watt and Burgess patent,) and whether the article produced is the same or substantially the same as that described in re-issued patent No. 1448, for a new manufacture; and if not, state why not; and state fully wherein the re-issued patent differs from
180 the above-mentioned patent of Lemuel William Wright, and in what respect they are for distinct and separate inventions.

A. I have examined said patent; it differs from the re-issued patents Nos. 1448 and 1449. The patentee employs straw and other fibrous substances, boils in lime, grinds, washes, digests in dilute solution of sulphuric or other acid, washes, reboils in an alkaline solution, washes, bleaches at a temperature of 212°, sours and washes. For boiling in the alkaline solution he does not state definitely the strength of the solution, but says the straw is to be again boiled for six hours in the lime-water, as before described; mixed with an alkaline solution of the specific gravity of 2° to 4° B. In the previous boiling in lime-water, the kier was to be filled half full of straw, and the remaining space with lime-water. If we suppose that, by the word mixed, he employs equal quantities of lime-water (milk of lime) and the above solution of soda ash, his strength would be from 1° to 2° B., or when rendered caustic by the action of lime, 0.81 to 1.72. It is only by repeated processes that he removes his intercellular tissue, if he remove it at all. In boiling both in lime and alkali he used close kiers of cast or wrought-iron, which are fitted with safety-valves, but from the construction of his boilers represented in the drawing attached to the specification, they would not be either tight or safe at a steam-pressure of two atmospheres.

Q. 30. Have you examined and are you familiar with the patent granted to Moses Poole, by the English government, July 10, 1844, No. 10242? and, if so, state whether such patent is for the same or substantially the same process as that described and claimed in re-issued patent No. 1449, (the Watt and Burgess patent,) and whether the article produced is the same or substantially the same as that described in re-issued patent No. 1448, for a new manufacture; and, if not, state why not; and state fully wherein the re-issued patent differs from the above-mentioned patent of Moses Poole, and in what respects they are for distinct and separate inventions.

A. I have examined said patent and am familiar with it. It differs from the re-issued patents Nos. 1448 and 1449. The patentee refers to the use of broom. He crushes and washes, then expresses the moisture
181 and boils in a liquor of lime, with or without a quantity of soda. The soda is about one per cent. of the material, and could produce practically no disintegration. He bleaches by chlorine in the gaseous or liquid state. He does not use pressure-boiling nor, practically, caustic alkali.

Q. 31. Have you examined and are you familiar with the patent granted to Jean Theodore Coupier and Marie Amédeé Charles Mellier, by the English government, February 23, 1852, No. 13959? and, if so, state whether such patent is for the same or substantially the same process as that described and claimed in re-issued patent No. 1449, (the Watt and Burgess patent,) and whether the article produced is the same or substantially the same as that described in re-issued patent No. 1448, for a new manufacture; and, if not, state why not; and state fully wherein

the re-issued patent differs from the above-mentioned patent of Jean Theodore Coupier and Marie Amédée Charles Mellier, and in what respects they are for distinct and separate inventions.

A. I have examined and am familiar with said patent. It differs from the re-issued patents Nos. 1448 and 1449. The patentees boil in a solution of caustic potassa or soda, not under pressure. They then treat with the hypochlorites, preferring the "hypochlorite of alumina." They do not produce a pulp directly by boiling in alkali at a sufficient temperature, but rely on the disintegrating effects of the hypochlorites. In another process nitric acid is used with wood as an agent for oxidizing the intercellulose. In this process no previous boiling is employed.

Q. 32. Have you examined and are you familiar with the patent granted to Burgess, Allison and Hawkins, of New Jersey, by the Government of the United States, December 30, 1802? and, if so, state whether such patent is for the same or substantially the same process as that described and claimed in re-issued patent No. 1449, (the Watt and Burgess patent,) and whether the article produced is the same or substantially the same as that described in re-issued patent No. 1448, for a new manufacture; and, if not, state why not; and state fully wherein the re-issued patent differs from the above-mentioned patent of Burgess, Allison and Hawkins, and in what respects they are for distinct and separate inventions.

182 A. I have not examined said patent. It is among the lost patents which have not been restored.

Q. 33. Have you examined and are you familiar with the patent granted to William Magaw by the Government of the United States, February 19, 1830, re-issued patent for fourteen years, from March 8, 1828? and, if so, state whether such patent is for the same or substantially the same process as that described and claimed in re-issued patent No. 1449, (the Watt and Burgess patent,) and whether the article produced is the same or substantially the same as that described in re-issued patent No. 1448, for a new manufacture; and, if not, state why not; and state fully wherein the re-issued patent differs from the above-mentioned patent of William Magaw, and in what respects they are for distinct and separate inventions.

A. I have examined and am familiar with said patent. It differs from the re-issued patents Nos. 1448 and 1449. The patentee refers to hay, straw, and other vegetable substances. He boils in an open vessel in a solution of ashes, which would consist principally of carbonate of potassa. He states that steeping for several days answers as boiling. He does not use pressure-boiling.

Q. 34. Have you examined and are you familiar with the patent granted to Lewis Wooster and Joseph E. Holmes, by the Government of the United States, August 3, 1830? and, if so, state whether such patent is for the same or substantially the same process as that described and claimed in re-issued patent No. 1449, (the Watt and Burgess patent,) and whether the article produced is the same as that described in re-issued patent No. 1448, for a new manufacture; and, if not, state why not; and state fully wherein the re-issued patent differs from the above mentioned patent of Lewis Wooster and Joseph E. Holmes, and in what respects they are for distinct and separate inventions.

A. I have examined said patent, and am familiar with it. It differs from the re-issued patents Nos. 1448 and 1449. It is for the purpose of making paper from wood. The specification is somewhat obscure, but it is probable that the patentees used caustic alkali and boiled. They do not mention boiling. They do not use pressure.

183 Q. 35. Have you examined and are you familiar with the patent granted to Coupier and Mellier, by the Government of the United States, August 2, 1853, for fourteen years, from May 7, 1851? and, if so, state whether such patent is for the same or substantially the same process as that described and claimed in re-issued patent No. 1449, (the Watts and Burgess patent,) and whether the article produced is the same or substantially the same as that described in re-issued patent No. 1448, for a new manufacture; and, if not, state why not; and state fully wherein the re-issued patent differs from the above mentioned patent of Coupier and Mellier, and in what respects they are for distinct and separate inventions.

A. I have examined and am familiar with said patent. It differs from the re-issued patents Nos. 1448 and 1449. The patentees do not use a temperature above 230° F., and do not rely on boiling in alkali for pulping, but rather on the disintegrating effects of the hypochlorites. I do not believe that wood could be pulped by boiling in alkali at that temperature.

Q. 36. Have you examined and are you familiar with the patent granted to Montgolfier frères, by the government of France, February 7, 1838, No. 9215, and certificates of addition thereto, dated October 5, 1838, October 16, 1838, &c., Brevets d'Invention, 1st series, 67th vol., pages 15 to 26, both inclusive, and plate 2? and, if so, state whether such patent is for the same or substantially the same process as that described and claimed in re-issued patent No. 1449, (the Watts and Burgess patent,) and whether the article produced is the same or substantially the same as that described in re-issued patent No. 1448, for a new manufacture; and, if not, state why not; and state fully wherein the re-issued patent differs from the above-mentioned patent of Montgolfier frères, and in what respects they are for distinct and separate inventions.

A. I have examined and am familiar with said patent. It differs from the re-issued patents Nos. 1448 and 1449. In the Montgolfier process the wood is rasped down, steeped in lime-water to soften it, ground, boiled in caustic alkali solution, under pressure—what pressure is not stated—crushed between two rollers, reboiled in alkali, bleached by chlorine and soda, in vacuo. In their second re-issue they state that, after the boiling in alkali, the wood may be converted into a
184 white pulp, by means of their process of bleaching. They state that the usual bleaching process will not answer on the pulp produced as above, and refer the failure to the fact that all the resin had not been removed from the wood. This is rendered plain from the fact that in the wood which was not disintegrated by the bleaching process, they recement the fibres by the removed resin, which would show that the fibre could not be converted into paper without cementing action. That they obtain merely disintegrated wood and not pure pulp is clearly proved by the fact that they put down the total loss in converting wood into pulp at 30 per cent., that is they obtain 70 per cent. of fibre. Now wood of average dryness will only give from 30 to 35 per cent. of pure fibre. They give the cost at 10 francs the 100 kilos.; while they state that the cost of rags was sixty-three francs the 100 kilos. If the pulp obtained would really make paper at this great profit the process would have come into practical use, which I have every reason to believe was not the case. By practical use, I mean its employment on the large scale to produce a commercial article.

Q. 37. Have you examined and are you familiar with the patent granted to Charles Wise, by the government of France, May 12, 1838, Brevets d'Invention, 1st series, vol. 43, pp. 37, 38, 39, and 40, and plates

therein referred to? and, if so, state whether such patent is for the same or substantially the same process as that described and claimed in re-issued patent No. 1449, (the Watt and Burgess patent,) and whether the article produced is the same or substantially the same as that described in re-issued patent No. 1448, for a new manufacture; and, if not, state why not; and state fully wherein the re-issued patent differs from the above-mentioned patent of Charles Wise, and in what respects they are for distinct and separate inventions.

A. I have examined and am familiar with said patent. It differs from the re-issued patents Nos. 1448 and 1449. It is a patent for a boiler for boiling rags and other materials in alkaline solutions for the purpose of paper-making. The patent includes two classes of boilers, the one stationary, the other rotary. The stationary boiler is heated by fire placed under it, the rotary one by steam. In neither case is pres-
185 sure alluded to, although it is to be presumed that it would be obtained. The patent is for an apparatus, and not for the chemical decomposition of wood, straw, or other vegetable substances, which depends upon a certain quantity of chemical material at a certain temperature.

Q. 38. Have you examined and are you familiar with the patent granted to Monier Legoux, by the government of France, March 12, 1839, Brevets d'Invention, tome 52, pp. 413, 414, 415, and plate? and, if so, state whether such patent is for the same or substantially the same process as that described and claimed in re-issued patent No. 1449, (the Watt and Burgess patent,) and whether the article produced is the same or substantially the same as that described in re-issued patent No. 1448, for a new manufacture; and, if not, state why not; and state fully wherein the re-issued patent differs from the above-mentioned patent of Monier Legoux, and in what respects they are for distinct and separate inventions.

A. I have examined and am familiar with the patent alluded to. It differs from the re-issued patents Nos. 1448 and 1449. The patentee reduces vegetable substances, among which he mentions wood, to a material resembling rag half-stuff. (Une espéce de fillasse resemblant un défile product par les chiffens.) He then boils this product under a pressure of three or four atmospheres in a solution of boracic acid, containing common soap, as caustic as possible. After washing, he states the material is fit for paper-making. The only effect of the boracic acid would be to neutralize some of the alkali of the soap. The boiling process was evidently only a softening of the mechanically disintegrated wood; no real chemical disintegration could be obtained with such weak chemical agents. The patentee states that the process may be rendered more effective by a previous maceration in a caustic lye composed of two parts, one of barilla soda or potash, the other of boracic acid and unslacked lime. In this case the acid would combine with the alkalies present to form borates.

Q. 39. Have you examined and are you familiar with the patent granted to Le Sieur Clothan Breuil, à Paris, by the government
186 of France, February 12, 1846, Brevets d'Invention, 2 series, vol. 6, pp. 60 and 61, No. 1440? and, if so, state whether such patent is for the same or substantially the same process as that described and claimed in re-issued patent No. 1449, (the Watt and Burgess patent,) and state whether the article produced is the same or substantially the same as that described in re-issued patent No. 1448, for a new manufacture; and, if not, state why not; and state fully wherein the re-issued patent differs from the above-mentioned patent of Clothan Breuil, and in what respects they are for distinct and separate inventions.

A. I have examined and am familiar with said patent. It differs from the re-issued patents Nos. 1448 and 1449. The patent refers chiefly to the bark of vegetables which is boiled in a weak solution of soda not rendered caustic, under a pressure of two or three atmospheres. It is evident that the patentee does not use sufficient alkali or a high enough temperature, as the material is, after the boiling, submitted to a braking, dressing, or combing. This last process is impossible if anything like a pulp had been obtained. The small quantity of uncausticized alkali could have only softened the bark. He calls attention to the fact that only weak alkaline solutions should be used.

In making paper he exposes the bark to a boiling in weak caustic alkali, 2 kilos. to 100 kilos. of material. As a proof that the alkaline treatment has not removed the intercellular matter he goes on to describe that they must be removed by a light breaking down which loosens them, after which they are carried away by washing. The only reference made to wood is to branches of osier and willow. He states that the alkaline treatment is the same, but employs stronger mechanical action. There is nothing to show that anything like pulping by alkaline solutions was attempted. It was only a softening of the article preparatory to its removal; not a chemical disintegration of the vegetable matters, as in the Watt and Burgess patent.

Q. 40. Have you examined and are you familiar with the patent granted to Le Sieur Gros, aux Batignolles, (Seine,) by the government of France, March 20, 1847, No. 2666, Brevets d'Invention, series 2, pp. 94, 95, and 96? and, if so, state whether such patent is for the same or sub-
187 stantially the same process as that described and claimed in re-issued patent No. 1449, (the Watt and Burgess patent,) and whether the article produced is the same or substantially the same as that described in re-issued patent No. 1448, for a new manufacture; and if not, state why not; and state fully wherein the re-issued patent differs from the above-mentioned patent of Le Sieur Gros, and in what respects they are for distinct and separate inventions.

A. I have examined and am familiar with said patent. It differs from the re-issued patents Nos. 1448 and 1449.

This patent is for the manufacture of pulp from broom only. He treats the bark and wood separately.

The patentee boils the bark, without pressure, in alkaline solutions, either in lime alone or of lime mixed with soda. He then beats in an engine and bleaches. He boils the wood under a pressure of three or four atmospheres in an alkaline solution, of which the strength is not definitely set forth. He states that for a pulp intended for the various qualities of white paper (pâte) should be boiled for about six or eight hours, (for that gathered during the spring and summer,) with about 10 per cent. of its volume of solution of sal soda, (crystalized carbonate of soda,) with about 5 per cent. of caustic lime. For broom cut in autumn and winter it will require eight to twelve hours in a lye-bath containing about 15 to 20 per cent. (of the volume of the pulp) of the same solution, which is rendered caustic more or less, by about 5 per cent. of caustic lime. After this boiling the wood is, without washing, to be heaped up for fifteen days, then placed in the engine and crushed with the roll until it looks like a mass of unravelled fabric. It is then boiled as at first and completely beaten out. It is then washed, submitted to the action of chlorine gas, again washed and bleached.

In this patent the treatment with alkali is only a preparatory softening process. The real disintegration is effected by mechanical means, that is, the beating in the rag-engine. If this were not so, the expres-

sion "effilaché completement et plus fin que pour les chiffens" would not have been used. If it were completely pulped by chemical means, as in the Watt and Burgess process, no such violent beating would
188 have been necessary, a very slight mechanical action sufficing to separate the isolated fibres after the intercellulose has been removed. In the defendant's answer it is stated that "the lye used is 15 to 20 per cent. of the volume of salt of soda (sel de soude) rendered caustic with about 5 per cent. of quicklime." There is an error here in the translation. The expression in the original is 15 to 20 per cent. of the volume of the pulp. Sel de soude is commercial crystalized carbonate of soda. In either case it is difficult if not impossible to say how the relative volumes of the bodies could be determined. These determinations are in practice always made by weight.

Q. 41. Have you examined and are you familiar with the patent granted to Messrs. Coupier and Mellier, by the government of France, May 17, 1851, Brevets d'Invention, 2 series, vol. 19, pp. 145, 146, and 147? and if so, state whether such patent is for the same or substantially the same process as that described and claimed in re-issued patent No. 1449, (the Watt and Burgess patent,) and whether the article produced is the same or substantially the same as that described in re-issued patent No. 1448, for a new manufacture; and if not, state why not; and state fully wherein the re-issued patent differs from the above-mentioned patent of Coupier and Mellier, and in what respects they are for distinct and separate inventions.

A. I have examined said patent and am familiar with it. It is substantially the same as that referred to in answers Nos. 31 and 35.

Q. 42. Have you examined carefully and thoroughly all the patents and all the books and articles referred to in the answer of the defendants in this case; and if so, do you find that any one describes the production from wood of a pulp fit to be made into paper without admixture?

A. I have done so, except the patent of Burgess, Allison and Hawkins, which has not been restored. There is no description of a process by which wood could practically be made into a pulp fit to be made into white paper without admixture.

Q. 43. Can you divide the inventions and processes described in said patents and articles into classes or groups according to their char-
189 acteristics? If so, make such arrangement of them, and show in what characteristics they differ essentially from the inventions of Watt and Burgess.

A. The inventions and processes may be divided as follows:

The following do not boil under pressure:

Hector Campbell, English patent.....1792, No. 1922
William Cunningham, English patent.....1794, No. 2026
Matthias Koops, English patent.....1801, No. 2481
James V. Desgrand, English patent.....1838, No. 7643
George R. D'Harcourt, English patent.....1838, No. 7772
Morton Balmanno, English patent.....1838, No. 7794
Edward Cooper, English patent.....1838, No. 7850
John Small, English patent.....1838, No. 7883
Miles Berry, English patent.....1839, No. 8273
Moses Poole, English patent.....1844, No. 10252
Coupier and Mellier, English patent.....1853, No. 13979
William Morgan, American patent.
Wooster and Holmes, American patent.
Regnault's Chemistry, vol. 2, p. 447 and 448.

Of the above the following do not practically use caustic alkali: Koops, Desgrand, D'Harcourt, Poole, Small, Berry. Of the above the following do not refer to wood or straw: Campbell, Cunningham, Trumbull, Balmanno, Poole.

The following do not refer to the manufacture of paper pulp: John Trumbull, Regnault's Chemistry.

The following use pressure, but below 300° F.: John Trumbull, Lemuel W. Wright, Coupier and Mellier, French and American patents, Clothan Breuil.

Wise claims an apparatus; not process or a product.

The following use pressure-boiling, but do not use caustic alkali: Monier Legoux, Clothan Breuil.

In the following, caustic alkali and pressure-boiling are used; but from the specifications it is evident that the material was not pulped by chemical means: Montgolfier Frères, Sieur Gros.

Q. 44. Have you examined the boilers and apparatus described in the patents and articles referred to in the defendants' answer as applicable to the patented boiler of Morris L. Keen? and if so, state whether you find substantially the same inventions described in any of them.

190 A. I have examined the description of said boiler and apparatus. The invention described is not substantially the same as that patented by Morris L. Keen.

Q. 45. Examine the specification of the patent granted in the United States to Marie Amédée Charles Mellier, bearing date May 26, 1857, antedated August 7, 1854, and state whether you understand the same; and if so, state the characteristics of said invention.

A. I have examined said specification, and understand the same. The characteristics are the use of a rotary boiler in which the heat is applied by means of steam, which is kept apart from the material, and a temperature of not less than 310° F., with caustic soda, for the purpose of converting straw and similar vegetable fibrous materials into a material suitable for the manufacture of paper.

Q. 46. Is there any discrepancy between the degrees of temperature and the amount of pressure described in the specification? If so, state what it is, and give your explanation of the same.

A. The temperature and pressure in the Mellier specification do not apparently correspond. He says: "A pressure internally of the boiler equal to or exceeding seventy pounds, that is, 300° F." This apparent discrepancy results from the fact that, in France, in stating pressures, the total internal pressure on the boiler is given, which is about fifteen pounds greater than that indicated by the safety-valve or gauge used in this country, which indicates the pressure above that of the atmospheric. The French tables start from a vacuum, as 0, of pressure; our gauges, at one atmosphere, or 15 pounds per square inch. The French atmosphere is about 14.7 pounds per square inch. Making this allowance, and assuming Mellier's pressure as five atmospheres, we find that it corresponds to a total internal pressure of 73.5 pounds, or a safety-valve pressure of 58.8 pounds, which, with an alkaline solution of 2° B., and wood in the proper proportion to the alkali, corresponds to a temperature of about 310° F. I have not determined the temperature at that pressure with straw and caustic alkali at 2° B., but believe that it would not materially differ from that above stated.

191 Q. 47. Have you examined and are you familiar with the following-described patents, viz: Hector Campbell, by the English government, November 28, 1792, No. 1922; William Cunningham, by the English government, November 28, 1794, No. 2026; John Trumbull, j'r,

by the English government, November 15, 1800, No. 2449; Matthias Koops, by the English government, February 17, 1801, No. 2481; James Vincent Desgrand, by the English government, May 15, 1838, No. 7643, George Robert D'Harcourt, by the English government, August 15; 1838, No. 7772; Morton Balmanno, by the English government, September 6, 1838, No. 7794; Edward Cooper, by the English government, November 3, 1838, No. 7850; John Small, by the English government, December 1, 1838, No. 7883; Miles Berry, by the English government, November 19, 1839, No. 8273; Lemuel William Wright, by the English government, June 15, 1843, No. 9787; Moses Poole, by the English government, July 10, 1844, No. 10252; Jean Theodore Coupier and Marie Amédée Charles Mellier, by the English government, February 23, 1852, No. 13979; Burgess, Allison and Hawkins, of New Jersey, by the Government of the United States, December 30, 1802; William Magaw, by the Government of the United States, February 19, 1830, re-issued patent for fourteen years, from March 8, 1828; Lewis Wooster and Joseph C. Holmes, by the Government of the United States, August 3, 1830; Coupier and Mellier, by the Government of the United States, August 2, 1853, for fourteen years, from May 7, 1851; Montgolfier Frères, by the government of France, February 7, 1838, No. 9215, and certificates of addition thereto, dated October 5, 1838, October 16, 1838, &c., Brevets d'Invention, 1st series, 67th vol., pp. 15 to 26, both inclusive, and plate 2; Charles Wise, by the government of France, May 12, 1838, Brevets d'Invention, 1st series, vol. 43, pp. 37, 38, 39, and 40, and plate therein referred to; Monier Legoux, by the government of France, March 12, 1839, Brevets d'Invention, tome 52, pp. 413, 414, and 415, and plate; Le Sieur Clothan Breuil, à Paris, by the government of France, February 12, 1846, Brevets d'Invention, 2 series, vol. 6, pp. 60 and 61, No.
192 1140; Le Sieur Gros, aux Batignolles, (Seine,) by the government of France, March 20, 1847, No. 2666, Brevets d'Invention, series 2, pp. 94, 95 and 96; Messieurs Coupier and Mellier, by the government of France, May 17, 1851, Brevets d'Invention, 2 series, vol. 19, pp. 145, 146, and 147? and if so, state whether each of such patents is for the same or substantially the same process and invention as that described and claimed in the specification and claim of said Mellier patent; and if not, state why not; and state fully wherein said Mellier invention differs from each of the patented processes described in said patents, and in what respects the said Mellier patent is for a new, distinct, and separate invention.

A. I have examined said patents, and am familiar with them, except that of Burgess, Allison and Hawkins, of New Jersey, which has been lost and not restored. In none of the patents named is a temperature used approaching that of 310° F., with caustic alkali in the quantity necessary to produce chemical disintegration of the vegetable substance.

Q. 48. State whether or not the process used by the defendants, so far as that process relates to straw or other than wood substances, is the same or substantially the same as that patented by said Mellier.

A. It is. If the defendants, as has been testified, used a steam pressure of sixty pounds, they exceeded a temperature of 310° F.

Q. 49. Have you examined, and are you familiar with Regnault's Chemistry, vol. 2, pp. 447 and 448? and, if so, state whether such book describes the same, or substantially the same, processes as that described and claimed in re-issued patent No. 1449, (the Watt and Burgess patent,) and whether the article produced in said book is the same or substantially the same as that described in re-issued patent No. 1448,

for a new manufacture; and, if not, state why not; and state fully wherein the said re-issued patents differ from the process and product described in said book, and in what respects the said re-issued patents are for new, distinct, and separate inventions.

A. I have examined Regnault's Chemistry, vol. 2, pp. 447 and 448, American edition. The author describes a method of obtaining cellu-
193 lose by treatment with caustic alkali in open vessels, and subsequently by oxidizing agents, as weak solutions of chlorine and hypochlorite of lime. These operations are to be repeated after each treatment with the oxidizers. Caustic alkali and muriatic acid are to be used. No mention is made of pressure-boiling, and the complex process named differs essentially from the simple process of pulping at a single operation by the use of the proper quantity of alkali and the proper temperature as in the re-issued patents Nos. 1448 and 1449.

Q. 50. Have you examined and are you familiar with Regnault's Chemistry, vol. 2, pp. 447 and 448? and, if so, state whether such book describes the same or substantially the same process as that described and claimed in the specifications and claim of the Mellier patent, mentioned in the foregoing forty-fifth interrogatory; and, if not, state why not; and state fully wherein said Mellier invention differs from the process described in said book, and in what respects the said Mellier patent is for a new, distinct, and separate invention.

A. I have examined said work and am familiar with it. The process is not substantially the same as that of Mellier's patent, as no pressure is used. Mellier's patent claims the use of a temperature of not less than 310° F. The characteristics of Mellier's patent have been given in my answer to interrogatory No. 45.

Q. 51. Do you know or can you set forth any other matter or thing which may be a benefit or advantage to the parties at issue in this cause, or either of them, or that may be material to the subject of this, your examination, or the matters in question in this cause? If yea, set forth the same fully and at large in your answer.

A. A careful study of the whole subject of the manufacture of paper-pulp from substances other than rags and allied matters has satisfied me that cellulose for paper-making was first practically obtained from wood and allied snbstances, under the Watt and Burgess patent. In a work entitled "Novelties, Inventions, and Curiosities in Arts and Manufactures," published in London, in 1858, is the following article on "straw-paper:"

"Hopes were entertained some years ago that good paper
194 might be made from straw. One of the principal tanneries in Bermondsey, called Neckinger Mills, was originally a straw-paper mill. It appears that the straw was cut up into pieces two or three inches in length, steeped in cold lime-water, and cut into infinites'imal fragments in a paper mill. The pulp thus produced was made into paper by the usual train of processes. But the enterprise failed in Bermondsey, and a second time at Thames Bank. The paper produced was harsh and ill-colored. A further attempt was made to brave the difficulties; additional processes were adopted to free the straw from knots, to extract the coloring matter, to dispose it to become fibrous, to free it from mucilage and silicious particles, and also from the odor of many of the chemicals adopted in the former processes—all means here adopted in short to coax it to become a good paper-making material; but these numerous processes became at length very costly, and the straw-paper was neither fine enough nor strong enough to command an adequate price; so it died a commercial death."

Gemelin's Hand-Book of Chemistry, vol. 16, 1862, (Cavendish edition,) a standard authority, gives twelve methods of obtaining cellulose, but does not mention pressure.

In Watt's Dictionary of Chemistry, the latest authority, vol. 1, London, 1863, we have the following: "To obtain pure cellulose from wood it is necessary, after boiling the wood with potash till the liquid is almost dry, to treat it with chlorine water or a weak solution of chloride of lime, repeating these successive operations several times, in order to free the cellular tissue from the encrusting matter which is so intimately united with it. The vegetable fibres in the excrements of herbivorous animals furnish a convenient source of cellulose, because the encrusting matter has been already removed or disintegrated to a great extent by the process of digestion, so that the cellular substance which remains is much easier to purify than the tissue of the plant in its natural state."

In the defendants' answer is the following statement: "The plaintiffs have at length succeeded in making pulp from bass-wood and poplar chips, which serves to adulterate rags and mix with straw-pulp."

195 This statement is incorrect, as good commercial paper is now made wholly from wood.

B. HOWARD RAND.

Sworn and subscribed before me this fifteenth day of February, A. D. 1867.

AUBREY H. SMITH,
Special Examiner.

The counsel for the plaintiffs now closes his examination-in-chief of the witness B. Howard Rand.

Examination adjourned to 22d February, 1867, at 1 p. m.

OFFICE OF THE EXAMINER,
137 SOUTH FIFTH STREET, PHILADELPHIA,
February 22d, 1867—1 *p. m.*

Present, Mr. Wallace, for the plaintiffs, and B. Howard Rand, the witness under examination.

At the request of the counsel for the defendants, the examination is adjourned to February 23d, 1867, at 11 a. m.

OFFICE OF THE EXAMINER,
137 SOUTH FIFTH STREET, PHILADELPHIA,
February 23d, 1867—11 *a. m.*

Present, Mr. Wallace, for the plaintiffs, and Mr. Harding, for the defendants.

B. Howard Rand, the witness, being in attendance for cross-examination, at the request of the defendants' counsel, the examination is adjourned to Tuesday, 26th February, 1867, at 12 m.

OFFICE OF THE EXAMINER,
137 SOUTH FIFTH STREET, PHILADELPHIA,
February 26th, 1867—12 *m.*

Present, Mr. Wallace, for the plaintiffs.

The counsel for the defendants not being present, the examination is adjourned to February 27th, 1867, at 12 m.

196 OFFICE OF THE EXAMINER.
137 SOUTH FIFTH STREET, PHILADELPHIA,
February 27th, 1866—12 *m.*

B. Howard Rand, the witness under examination, appears for cross-examination. Neither of the counsel being present, the examination is adjourned to February 28th, 1866, at 12 m.

OFFICE OF THE EXAMINER,
137 SOUTH FIFTH STREET, PHILADELPHIA,
February 28th, 1867—12 *m.*

None of the counsel or parties appearing, the examination of the witness B. Howard Rand, is terminated, and the commission closed in accordance with the terms thereof.

197 Depositions of witnesses produced to and sworn and examined on the twenty-fifth and twenty-sixth days of February, A. D. 1867, by Aubrey H. Smith, special examiner, at his office, No. 137 South Fifth street, in the city of Philadelphia, under and by virtue of an order made by the said court, in the said cause, on the twenty-first day of January, A. D. 1867. A certified copy of which order is hereunto annexed for the examination of witnesses therein named, in the cause aforesaid.

OFFICE OF THE EXAMINER,
137 SOUTH FIFTH STREET, PHILADELPHIA,
February 25th, 1867.

JOHN RANDOLPH, a witness produced on behalf of the plaintiffs, and examined, by consent of counsel for both parties, in their absence, being duly sworn, saith as follows:

(A certain paper, purporting to be executed by Morris L. Keen, and by the American Wood-Paper Company, dated the eleventh day of July, 1865, marked by the examiner, Exhibit A. H. S., 8, being shown to the witness, he says:)

I am one of the subscribing witnesses to the said paper, and my name, subscribed thereto as a witness, is in my proper handwriting. I saw Morris L. Keen subscribe his name as one of the parties thereto.

JOHN RANDOLPH.

Sworn and subscribed this twenty-fifth day of February, A. D. 1867, before me.

AUBREY H. SMITH,
Special Examiner.

198 OFFICE OF THE EXAMINER,
137 SOUTH FIFTH STREET, PHILADELPHIA.
February 26th, 1867.

JOHN FARRELL, a witness produced on behalf of the plaintiffs, being duly sworn, saith as follows:

(A certain paper, dated the eighteenth day of May, A. D. 1863, purporting to be executed by William F. Ladd and Morris L. Keen, marked by the examiner, Exhibit A. H. S., 9, being *being* shown to the witness, he says:)

My name, subscribed to this paper, as one of the witnesses to the signature of Morris L. Keen, is in my proper handwriting.

(Another paper, bearing the same date, purporting to be executed by Morris L. Keen, marked by the examiner, Exhibit A. H. S., 10, being shown to the witness, he says:)

My name, subscribed to this paper, as one of the witnesses to the signature of Morris L. Keen, is in my proper handwriting.

JOHN FARRELL.

Sworn to and subscribed before me, this twenty-sixth day of February, A. D. 1867.

AUBREY H. SMITH,
Special Examiner.

199 *Examination before Kenneth G. White, esq., February* 23, 1867.

Present, Mr. Nye, for complainants; no one appearing for defendants.

ALBERT J. DELATOUR, being duly sworn on the part of the complainants, deposeth and saith, as follows:

Q. 1. What is your name, age, residence and occupation?

A. Albert J. Delatour, age forty-one; New York City; out of business since January first.

Q. 2. Do you know William F. Ladd, of Tarrytown, Westchester County, and State of New York?

A. I do.

Q. 3. Look at the instrument now shown to you and marked "Exhibit K, K. G. W., examiner, &c.," and state whether your signature to the same as a subscribing witness to the execution thereof, is genuine, and whether you saw the said William F. Ladd, execute the same, and whether his signature thereto is genuine.

A. I did subscribe said instrument as subscribing witness, and my signature thereto is genuine. To the best of my belief, I saw William F. Ladd sign said instrument; the signature I know to be his. I signed said instrument as subscribing witness, at the request of Mr. Ladd.

Q. 4. Examine Exhibit "C," annexed to the complainants' bill of complaint, and state whether the same is a correct copy of the said original instrument now shown to you.

A. I have compared them and find Exhibit C to be a correct copy.

A. J. DELATOUR.

Subscribed and sworn to before me, this 23d day of February, 1867.

KENNETH G. WHITE,
Examiner, &c.

Above deposition of A. J. Delatour, taken under a stipulation signed by solicitors for respective parties, and dated February 20th, 1867, and which stipulation is hereto annexed.

Adjourned to 26th inst., at 11 a. m.

200 FEBRUARY 26, 1867.

Present, counsel for complainants; counsel for defendants not present.

FREDERICK S. VANDERPOEL, being duly sworn on the part of the complainants, deposeth and saith, as follows:

Q. 1. What is your name, age, residence and occupation?

A. Frederick S. Vanderpoel; forty-seven; 72 West Fourth street, New York City; insurance agent.

Q. Do you know Coe. S. Buchanan, of the city, county and State of New York?

A. I do.

Q. 3. Look at the instrument now shown to you and marked "Exhibit L, K. G. W., examiner, &c.," and state whether your signature to the same as a subscribing witness thereto, to the execution thereof, is genuine, and whether you saw the said Coe. S. Buchanan execute the same, and whether his signature thereto is genuine.

A. My signature is genuine; and I saw Mr. Buchanan execute said instrument, and his signature thereto is genuine.

Q. 4. Examine Exhibit I, annexed to the complainants' bill of complaint, and state whether the same is a correct copy of the said original instrument now shown you.

A. I believe it to be so. I have examined.

FREDERICK S. VANDERPOEL.

Subscribed and sworn to before me, this 26th day of February, 1867.

KENNETH G. WHITE,
Examiner, &c.

Adjourned to February 27th, at 11 o'clock, a. m.

201 27TH FEBRUARY, 1867.

Present, counsel for complainants; no one appearing for defendants.

ALANSON NASH, being duly sworn on the part of complainants, deposeth, and saith as follows:

Q. 1. What is your name, age, residence, and occupation?

A. My name is Alanson Nash. I am aged sixty-six years, 1st March; reside at 111 East Thirty-ninth street, New York City; am a counseller at law.

Q. 2. Were you acquainted, in the year 1857, with Joseph Henry Nash, of the city of New York?

A. I was. He was my son. He died on the 5th day of October, 1864.

Q. 3. Was he a commissioner of deeds for the city and county of New York; and if so, where was his office?

A. He was a commissioner of deeds for the city and county of New York, and acted as such on the 19th day of June, 1857, and he was practicing law, and kept his office at 36 Beekman street.

Q. 4. Are you acquainted with his handwriting?

A. Yes, sir; I am very well acquainted with it, having seen him write almost daily from the time he was a school-boy, in 1837–8–9, and up to the time of his death.

Q. 5. Look at the instrument now shown to you and marked "Exhibit M, K. G. W., examiner, &c.," and state whether the name thereto appended and purporting to be the subscribing witness to said instrument is the handwriting of the said Joseph Henry Nash, and his genuine signature.

A. The body of the whole instrument is in his handwriting, and the certificate of acknowledgment is in his handwriting. He is the subscribing witness to the instrument, and it is in his handwriting. The certificate of acknowledgment is in his handwriting; and I think the certificate of acknowledgment was dictated by myself personally; and I think that the paper was executed at 36 Beekman street, where I kept

my own office. I am not acquainted with either M. A. C. Mellier
202 or V. Beaumont. The seal is paper that came from my office.

Q. 6. Did you see the said Joseph Henry Nash sign said instrument as subscribing witness?

A. I have no doubt in my own mind that I did, and yet I would not swear that I did positively, it being ten years since it was executed.

Q. 7. Examine Exhibit G, annexed to the complainants' bill of complaint, and state whether the same is a correct copy of said original instrument now shown to you?

A. I have so examined it and find it a copy in all its parts of the said original assignment, and the certificate of the Commissioner of Patents, C. Mason.

ALANSON NASH.

Subscribed and sworn to before me, this 27th day of February, 1867.

KENNETH G. WHITE,
Examiner, &c.

Adjourned to February 28th, at 11 o'clock, a. m.

FEBRUARY 28, 1867.

Present, counsel for complainants; counsel for defendants not present:

WILLIAM H. WALLACE, being duly sworn on the part of the complainants, deposeth and saith as follows:

Q. 1. What is your name, age, residence, and occupation?

A. William H. Wallace; age thirty-five; Brooklyn; merchant.

Q. Were you acquainted, in 1854, with Marie Amédée Charles Mellier, of New York?

A. I do not remember him.

Q. 3. Look at the instrument now shown to you and marked "Exhibit N, K. G. W., examiner, &c., and state whether your signature
203 to the same as a subscribing witness of the execution thereof, is genuine, and whether you saw the said Marie Amédée Charles Mellier, execute the same.

A. My signature is genuine. I do not remember the facts, but I am always very careful not to witness without seeing the execution.

Q. 4. Examine Exhibit F, annexed to the complainants' bill of complaint, and state whether the same is a correct copy of the said original instrument now shown to you.

A. It is.

WILLIAM H. WALLACE.

Subscribed and sworn to before me, this 28th day of February, 1867.

KENNETH G. WHITE,
Examiner, &c.

204 In the circuit court of the United States for the eastern district of New York.

THE AMERICAN WOOD-PAPER COMPANY }
vs.
THE FIBRE-DISINTEGRATING COMPANY. }

Examination before Kenneth G. White, esq., March 22, 1867.

Present, counsel for respective parties.

HUGH BURGESS, produced and sworn on the part of the complainants, deposes and says as follows, viz:

Q. 1. What is your name, age, residence and occupation?

A. Hugh Burgess. I am forty years old. I live at Royer's Ford, Penn.; chemist by profession.

Q. 2. Are you the person named in letters-patent of the United States, issued on the 18th day of July, 1854, for a new and useful improvement in the manufacture of paper from wood, as inventor of said improvement, in connection with Charles Watt, of London, England?

A. I am.

205 Q. 3. Do you know the said Charles Watt? Have you ever seen him write, and are you acquainted with his handwriting?

A. I know Charles Watt. I have seen him write, and know his handwriting of that date, 1854.

Q. 4. Have you ever seen a paper-writing executed by the said Charles Watt, purporting to make John Watt his attorney? If yea, describe the general character of the same, and state what was its date; whether it was sealed; and whether the same was the genuine instrument of the said Charles Watt.

(Objected to by the defendants.)

A. I have seen such paper. The purport of this paper was to enable John Watt to act as the attorney of Charles Watt; and it contained a power of substitution to a third party to act for John Watt. I do not remember the exact date of the paper. I believe it was the spring of 1854. I cannot remember the date. The paper was the genuine instrument of the said Charles Watt.

Q. 5. Was the paper you have described the genuine power-of-attorney of the said Charles Watt?

(Objection by the defendants.)

A. It was.

Q. 6. Have you made any efforts to procure the instrument you have described. If yea, with what success? Who last had possession of said instrument, and is the same now in existence?

(Objection by the defendants.)

A. I have. I have made search among all my papers; but, as I anticipated, without success, as I believed that Mr. John Watt took the paper back with him to England, in May, 1854. I believe Mr. John Watt had last possession of the instrument; but, as he is now dead, I cannot speak confidently as to the matter. I cannot say whether the paper is still in existence.

Q. 7. Do you remember the contents, or the substance of the contents of the instrument you have described? If yea, state the same fully and particularly.

(Objection by the defendants.)

206 A. The general purport of the papers was to constitute Mr. John Watt the attorney of Mr. Charles Watt. It also contained the power to Mr. John Watt to substitute a third party in his place. I cannot give a fuller account of the contents of the paper than I have done.

Q. 8. Have you stated the contents, in answer to the last interrogatory, from your own recollection of said instrument?

A. I have.

Q. 9. Was the instrument that you have described executed, to your knowledge, by the said Charles Watt, and was his signature to the same genuine?

(Objection by defendants.)

A. It was executed by Charles Watt, and the signature was genuine.

Q. 10. Were you acquainted with the John Watt you have mentioned? Have you ever seen him write, and do you know his hand-writing?

A. I knew John Watt. I have seen him write, and know his handwriting, being in correspondence with him at the time of his death.

Q. 11. Look at the instrument now shown to you, and marked "Exhibit O, K. G. W., examiner, &c.," and state whether you know the A. P. Harrison, whose name is subscribed as a witness to said instrument?

(Objection by defendants.)

A. I know Mr. A. P. Harrison, whose name is attached as a witness to said instrument.

Q. 12. Where is the said A. P. Harrison now?

A. I believe he is in New Orleans. He told me he was living there the last time I saw him, in 1865.

Q. 13. Have you ever seen the said A. P. Harrison write, and are you acquainted with his handwriting?

(Objection by defendants.)

A. I have frequently seen Mr. Harrison write. I know his handwriting.

Q. 14. Is the signature of the said John Watt to said instrument genuine?

(Objected by defendants.)

A. It is.

Q. 15. Do you know whether the said John Watt did anything,
207 and if so, what, under the instrument you have described as executed by the said Charles Watt, as the attorney of the said Charles Watt, after the execution of said instrument, and before substituting anybody in his place?

(Objection by defendants.)

A. He attended to such matters as at that time related to the probable future sale of the patent which was then being applied for. I remember his meeting some gentlemen who were introduced to him by Mr. F. B. Houghton, as likely to purchase the patent when granted. This was previous to my being substituted as attorney.

Q. 16. What patent do you refer to in your answer to the last interrogatory?

A I refer to the Watt and Burgess patent for the manufacture of paper from wood and other similar vegetable substances?

Q. 17. Was there ever in existence, to your knowledge, a paper-writing purporting to be an assignment of the American Watt and Burgess patent to Frederick B. Houghton? If yea, describe the general character of the same; state what patent was assigned, whether the instrument was sealed, and by whom it was executed.

(Objected by defendants.)

A. There was. The general character of this instrument was to transfer all the right and title of the American Watt & Burgess patent for the manufacture of paper from wood and other similar vegetable substances. The instrument was sealed. It was executed by me individually, and also as attorney for Charles Watt.

Q. 18. Was the instrument you have described in answer to the last interrogatory the genuine instrument of the assignors therein mentioned

(Qbjection by defendants.)

A. It was.

Q. 19. Have you made any efforts to procure the instrument you have described in answer to the last interrogatory but one? If yea, state of whom you have inquired touching the same, and what you have learned; who last had possession of said instrument, and is the same still in existence?

(Objection by defendants.)

208 A. I have. I have searched among my own papers and I have inquired of Mr. William F. Ladd and Mr. George Nelson and Mr. F. B. Houghton, who in reply to my inquiry states in a letter I now hold in my hand, "that nothing would give me greater pleasure than to send you the assignment or any other paper that might be of benefit to you, but I really have not the slightest idea of the whereabouts of any of our papers connected with the business; they may possibly be in the hands of Pattison & Wigg." He says further, "I will with pleasure write to Pattison & Wigg by to-day's post. If I am successful you will hear from me again shortly." This letter is dated Reading, in England, 8th December, 1866. I then received a letter from him, dated Reading, England, 14th December, 1866, in which he incloses me a letter from his solicitor, Mr. Pattison, of the firm of Pattison & Wigg, in which he states, "I have had the papers searched and also our documents, and can find no trace of any assignment from Watt & Burgess, nor do I recollect it." I believe Mr. F. B. Houghton last had the assignment in his possession. I cannot say whether it is still in existence or not.

(Answer objected to by the defendants.)

Q. 20. Do you know the F. B. Houghton you have mentioned; have you ever seen him write, and are you acquainted with his handwriting?

(Objection by defendants.)

A. I know Mr. Houghton. I know his handwritingg; have seen him write.

Q. 21. Is each of the letters to which you have referred in your answer to the last interrogatory but one, under date of 8th December, 1866, and 14th December, 1866, respectively, in the handwriting of the said F. B. Houghton, and is his signature to each of the same genuine?

(Objection by defendants.)

A. It is; and the signature to each of them is genuine.

Q. 22. Was each of said letters received by you in due course of mail?

(Objection by defendants.)

A. The first letter, bearing date the 8th of December, was handed to me by his brother, Vas Houghton, it being enclosed to him by F. B. Houghton in a letter from England. The second letter I received, I believe, in due course of mail.

209 Q. 23. Do you remember the contents, or the substance of the contents, of the assignment you have described in answer to preceding seventeenth interrogatory? If yea, state the same fully and particularly.

(Objection by defendants.)

A. I remember the substance of the contents of the assignment. It was to convey all the right, title, and interest in the Watt & Burgess American patent for the manufacture of paper from wood and other similar vegetable substances, to F. B. Houghton, for the sum of £5,000; one thousand pounds of which was to be paid in cash, and the remainder in notes at nine and eighteen months.

Q. 24. Was said assignment of the American Watt & Burgess patent to F. B. Houghton executed by you? If yea, in what capacities; and was your handwriting thereto as attorney for Charles Watt genuine; and was your signature thereto genuine?

(Objection by defendants.)

A. It was executed by me individually and as attorney for Charles Watt, and my signature in both cases was genuine.

Q. 25. Was there any agreement to sell the American Watt & Burgess patent to Frederick B. Houghton, after you were substituted for John

Watt, as the attorney for the said Charles Watt to sell said patent, and before you disposed of any interest individually or otherwise in said patent? If yea, in what capacity did you make said agreement? What were the terms of the same, and what was done in performance thereof?

(Objection by defendants.)

A. There was such an agreement made between myself and Mr. F. B. Houghton, after my substitution as attorney for John Watt, and previous to the assignment being made. I made the agreement individually, and as attorney for Charles Watt; the terms were the same as those stated in the assignment. The assignment was drawn and executed in accordance with the agreement. I handed the assignment to Mr. Houghton and he paid me £675, and gave me the notes at nine and eighteen months for four thousand pounds, according to the terms stated in the agreement.

Q. 26. Was any portion of the consideration you received for
210 said assignment from F. B. Houghton received by the said Charles Watt? If yea, what portion, and how was the same remitted?

(Objection by defendants.)

A. Of the cash received I remitted Mr. Charles Watt a bill of exchange for £625. I also sent Mr. Houghton's note at eighteen months for £1,562 10*s*., and also Mr. Houghton's note at nine months for £937 10*s*. The other notes I retained.

Q. 27. Was any thing done, to your knowledge; and if so, what, by the said F. B. Houghton, as the owner of the American Watt & Burgess patent, under said assignment to him, in reference to said patent and the business of manufacturing under it, after the execution of said assignment, and before the said F. B. Houghton disposed of his interest in said patent?

A. As owner of the said patent he made arrangements, the nature of which I do not exactly know, Mr. M. L. Keen to commence manufacturning paper-pulp from wood. Such arrangements were carried into effect. This was previous to said F. B. Houghton's disposal of his entire interest in said patent.

Cross-examined by Mr. Gifford, for defendants:

Q. 28. What connection, if any, have you with the American Wood-Paper Company, the complainants in this suit?

A. I am chemist to the company.

Q. 29. Have you any interest in that company? If yea, specify what it is.

A. I have an interest in the company, holding nearly nine hundred shares of the stock of the company.

Q. 30. How much is the stock per share at par value?

A. The par value of the stock is $100 a share.

Q. 31. Are you an officer of that company, or have you at any time been so? If yea, when?

A. I am chemist to the company, but not an officer of the company.

Q. 32. How long have you been interested in that company as a stockholder?

A. Since the formation of the company in 1863.

Q. 33. Where are the works of the company?

211 A. One mill is situated at Manayunk, near Philadelphia; the other at Royer's Ford, Pennsylvania.

Q. 34. Have you been before examined in this case? If yea, where and when?

A. I have been examined in this case previously, in Philadelphia.

Q. 35. Did you, on that examination, produce any samples of the material which could be used in the manufacture of paper-pulp or of paper?

(Objection by complainants, as not proper matter for cross-examination.)

A. I did.

Q. 36. By whom, where and when were those samples made?

(Objection by complainants for same reason.)

A. The samples I allude to were made by the Fibre-Disintegrating Company, at Brooklyn, in September, I believe, in 1865.

Q. 37. Why do you say you believe instead of answering upon your own knowledge?

(Objection by complainants for same reason.)

A. Because, without refreshing my memory from my notes, I cannot speak positively as to the exact time.

Q. 38. What person or persons, if you know, made those samples?

(Objection by complainants for same reason.)

A. I do not know the person who made the samples; but I collected them at the works of the company, from material under process of manufacture.

Q. 39. Then you did not see those samples made, did you?

(Same objection.)

A. The samples of brown paper I saw made; but not those bleached samples made from bamboo and other materials.

Q. 40. How long were you at these works at the time you say you gathered those samples, and with whom, if any one, did you converse while there?

(Same objection.)

212 A. I was there for perhaps an hour and a half. I conversed with Mr. Townsend. I do not now remember the initials of Mr. Townsend. He was introduced to me as the superintendent.

Q. 41. If, in your examination in this case, you have stated that the samples above referred to are substantially in the same condition and of the same character as pulp produced by the re-issued patent No. 1448, and are produced substantially by the same process as that described in re-issued patent number 1449, then state what, in giving that answer, you assumed the process, described in the re-issued patent number 1449, to be.

(Same objection.)

A. I assumed that the process, described in re-issued patent No. 1449, is the removal of the intercellular tissue by the action of caustic alkali at a certain temperature.

Q. 42. Explain, in detail, what you assumed that process to consist of.

(Same objection.)

A. This process consists in the subjecting of wood and similar vegetable substances to the action of caustic alkali of a given strength, which should be about 12° Baumé to a temperature of about 370° Fahrenheit; but this temperature must vary with the character of the material under operation.

Q. 43. In comparing the above-mentioned samples with the process contained in said patent, how much did you assume that the temperature might be varied and still be within the process contained in the patent?

(Same objection.)

A. We claimed in the patent a temperature at, near, or about 300° Fahrenheit, and I assumed that we had the right to vary the temperature, according to the material under operation, to about that point, that is, at, near, or about 300° Fahrenheit.

Q. 44. In giving your testimony, at how much below 300 degrees did you assume would be within the process contained within the patent?

(Same objection.)

A. Within eight or ten degrees, or at such a temperature as would effect the desired object, namely, the removal of the intercellular tissue.

213 Q. 45. Suppose that the temperature of two hundred degrees would effect such removal, would that, according to your understanding of it, be within the process?

(Same objection.)

A. It would not.

Q. 46. Why not?

(Same objection.)

A. Because, from the experiments made previous to the granting of the patent, I did not find that caustic alkali in solution, at such temperature, would remove sufficient of the intercellular tissue to make a good pulp, and therefore I did not consider such a low temperature sufficiently effective to be included in the patent.

Q. 47. Then you consider, do you, that the question as to whether the temperature would or would not be within the process of the patent depends upon whether the boiling removes the intercellular tissue sufficiently to make a good pulp?

(Same objection.)

A. I do; as the object of the process is the production of a pulp capable of making a fair quality of paper.

Q. 48. In giving your testimony, have you assumed that boiling in a solution of caustic alkali, under a pressure of 200° degrees Fahrenheit, would be within the process of the patent?

(Same objection.)

A. I believe it would not be within the limits of the patent.

Q. 49. Why not?

(Same objection.)

A. Because I do not believe that, at that temperature, a workable pulp could be produced, except with the aid of very strong solutions and great length of time, which would prevent the process from being a mercantile success.

Q. 50. If you were to find a man boiling a material—that is, a wood or vegetable substance—in a solution of caustic alkali, under a pressure of 250°, and thereby making good pulp for paper, would he, in your judgment be practising the process described and specified in said patent?

(Same objection.)

A. If the temperature of the solution, in which the vegetable substance was being boiled, was at 250° Fahrenheit, I should not consider him as touching the patent in question.

214 Q. 51. How would it be if he used a temperature of 260° Fahrenheit?

(Same objection.)

A. If the temperature of the solution was 260°, I *no* not consider he would be infringing the patent.

Q. 52. How would it be if he were using a solution at a temperature of 270°?

(Same objection.)

A. I do not consider that, at that temperature, he would be infringing the patent, provided the solution was at that temperature.

(Same objection.)

Q. 53. How would it be if he was using a solution of 280° temperature, Fahrenheit?

(Same objection.)

A. I do not think he would be infringing the patent.

Q. 54. How would it be if he were using a solution at a temperature of 290° Fahrenheit?

(Same objection.)

A. I should consider that would come within the meaning of the words, at, near, or about 300° Fahrenheit.

Q. 55. At what temperatute of the solution between 280° and 290° do you think the process of the patent would commence?

(Same objection.)

A. It is almost impossible for me to state, within a degree or two, the effect of caustic alkaline solutions upon all vegetable substances, as temperature, per cent. of alkali, and length of time, greatly vary with the character of the vegetable substance under operation, and, therefore, the words at, near, or about were purposely used in the patent.

Q. 56. You say you cannot state within a degree or two. State as nearly as you can.

(Same objection.)

A. With vegetable substances of such mature growth as would make them applicable for paper-pulp purposes, to the best of my belief, I do not think a temperature under 290° could be successfully used, though young vegetable substances might be pulped at that temperature.

215 Q. 57. Do you think that young vegetable substances might be pulped at a temperature of the solution below 290° Fahrenheit; and if yea, how much below?

(Same objection.)

A. I have pulped young vegetable substances at a temperature lower than that, but I cannot remember now the precise temperature employed.

Q. 58. Do you know what temperature of the caustic solution would be equivalent to sixty pounds steam-pressure?

(Same objection.)

A. That will depend upon the density of the solution. At 5° Baumé the temperature would be about 310° Fahrenheit; but, as the solution became charged with vegetable matter, the temperature would rise above that amount.

Adjourned to Saturday, March 23d, at 11 o'clock.

Resumed March 23d, 1867. Present, counsel for respective parties.

Q. 59. In boiling water, what degree of temperature would represent or be equivalent to a steam-pressure of sixty pounds to the inch?

(Same objection.)

A. About 310°; that is, the water would be about 310°.

Q. 60. What scale do you use in making the computation?

(Same objection.)

A. Fahrenheit's scale.

Q. 61. You say that, in boiling with an alkaline solution of 5° Baumé, sixty pounds pressure is equivalent to 310° of temperature of the solution, Fahrenheit. Is the temperature higher in this case than it would

be of the water, if the boiling was in water instead of the alkaline solution?

(Same objection.)

A. If, in answer to interrogatory No. 58, I stated that the temperature of an alkaline solution of 5° Baumé was 310° Fahrenheit, at sixty pounds pressure, I made an error, as it should be 313°; consequently the temperature of a solution at 5° Baumé is about three degrees hotter than water, both being at a pressure of sixty pounds.

216 Q. 62. What do you understand that difference to be attributable to?

(Same objection.)

A. From the known law that temperatures of solutions increase with their densities.

Q. 63. At what steam-pressure do the complainants, in practical operation, boil vegetable substances in alkaline solution?

(Same objection.)

A. We practically use, with non-resinous woods, a pressure of about 140 pounds, with resinous woods, a pressure of about 150 pounds.

Q. 64. How many degrees of temperature would that pressure represent of the alkaline solution in which you boil, and what is the strength of that solution?

(Same objection.)

A. I have not all my tables of pressures and corresponding temperatures with me, but I believe that in a caustic alkaline solution of 12° Baumè, which is the strength we ordinarily use, a pressure of 140 pounds is about equivalent to a temperature of 366°, and that a pressure of about 150 pounds with the same strength of solution, is about equivalent to a temperature of 372°.

Q. 65. Do you consider boiling in a temperature of 366° to be boiling at a temperature of "at, near, or about" 300°?

(Same objection.)

A. No, I do not.

Q. 66. Why not?

(Same objection.)

A. Because, a temperature of 366° is not at, near, or about 300°.

Q. 67. Do you consider rags, linen and cotton ropes to be vegetable substances, within the patent No. 1449?

(Same objection.)

A. No, I do not?

Q. 68. Why not?

(Same objection.)

A. Because in linen and in cotton there is no intercellular
217 matter; whereas, in the vegetable substances referred to in the patent there is a very large amount of intercellular matter.

Q. 69. What vegetable substances are referred to in the patent, as you understand it?

(Same objection.)

A. Wood and vegetable substances possessing ligneous tissues.

Q. 70. As you understand it, what vegetable substances as such, are not or should not be included in the patent?

(Same objection.)

A. In taking out the patent, I intended that it should apply to all vegetable substances containing ligneous matter, and I know of no vegetable production that does not contain ligneous matter, when it has arrived at its maturity.

Q. 71. Do you consider cotton-waste to be a vegetable substance within the meaning of said patent?

(Same objection.)

A. No, I do not.

Q. 72. Why not?

(Same objection.)

A. Because clean cotton is pure cellulose or fibre, and contains no ligneous matter, as usually understood by that term.

Q. 73. Then you would not consider boiling cotton-waste in a solution of alkali, under a pressure equivalent to three hundred degrees temperature, within that patent, would you?

(Same objection.)

A. I should not.

Q. 74. At the time you state you visited the defendant's works at Brooklyn, did you see there in use what is known as the Spofford boiler?

(Same objection.)

A. Mr. Townsend did not show me such a boiler.

Q. 75. Did he show you any boiler? If yea, how many?

(Same objection.)

A. He showed me, I think, two upright boilers, and also, the boilers used for generating steam.

Q. 76. Were the two upright boilers alike?

(Same objection.)

A. To appearances, of what I saw, I should think they were?

218 Q. 77. To what extent did you examine them?

(Same objection.)

A. Both boilers were closed with their man-heads at the time of my visit. I therefore could only see the outside of the boiler, that is, the top where they were charged, and the lower portion, where the contents of the boiler were discharged.

Q. 78. If you have testified in this case that you have examined the letters-patent issued to Morris L. Keen, bearing date September 13th, 1859, and June 16th, 1863, and that you fully understand the invention therein described and claimed, then state what you understand to be the invention described and claimed in the one of those patents dated September 13, 1859.

(Same objection.)

A. I understand it to be a boiler placed vertically, and provided with a proper mode of keeping the contents of the boiler submerged beneath the solution; also, provided with a suitable valve or gate, for the discharge of the contents of the boiler from its lower end. It is also provided with stirrers and necessary steam-gauge.

Q. 79. Can you swear that either of the two upright boilers which you say Mr. Townsend showed you at the defendants' works had stirrers? If you can, then please describe such stirrers.

(Same objection.)

A. As both the boilers were closed, I could not see into their interior; but I saw on the outside of one, if not both, a gear arrangement, which Mr. Townsend told me was for the purpose of driving the stirrers. I think I understood him that the stirrers were not successful, and they thought of removing them, or perhaps had removed them at the time of my visit. My impression is that certainly one of the boilers was provided with stirrers at that time. I cannot describe these stirrers.

Q. 80. In giving your testimony in this case, have you assumed that such a boiler as you saw at the defendants' works would be within said patent, even if it did not contain a stirrer?

(Same objection.)

219 A. I assumed that if the boilers that I saw at the defendants' works did not contain a stirrer, they would not come within the limit of the Keen patent of the date of September 13th, 1859.

Q. 81. What have you assumed with reference to a necessity of a stirrer being of any particular kind to bring it within that patent?

(Same objection.)

A. I have assumed that in Keen's patent of September 13, 1859, he claims an arrangement of stirrer in connection with a boiler of that peculiar form and position.

Q. 82. Do you mean that it comprehends stirrers of all forms and all modes of operation?

(Same objection.)

A. No, I do not. I consider that the stirrers should be substantially of the same character and for the same purpose as those described in said Keen's patent.

Q. 83. What form of stirrers have you assumed are included in that patent, and what excluded therefrom?

(Same objection.)

A. I assumed that the stirrers should be of the same character as described in Keen's patent. I do not think that stirrers widely differing from the arrangement therein described would fall within the limits of that patent, so far only as relates to the stirrers.

Q. 84. Explain what you mean in your last answer by the words "same character?"

(Same objection.)

A. By the same character, I mean upright shafts provided with arms the whole forming a stirrer, revolving parallel to the long axis of the boiler.

Q. 85. In the boilers employed by the complainants in their works at Royer's Ford, are stirrers used?

(Same objection.)

A. They are not.

Q. 86. Have they ever been there?

(Same objection.)

A. They were used in a small boiler I believe.

Q. 87. How many boilers for boiling material, under pressure, in alkaline solution, are in use at that establishment?

220 (Same objection.)

A. Four.

Q. 88. How long have they been in use there?

(Same objection.)

A. Since, I believe, July, 1860.

Q. 89. Is the small one you have above mentioned one of those four?

(Same objection.)

A. It is not.

Q. 90. Have the complainants any other works than those at Royer's Ford?

(Same objection.)

A. They have.

Q. 91. Where; and state, if you know, whether stirrers are used in their boilers there?

(Same objection.)

A. The works are at Manayunk, near Philadelphia; stirrers are not used in the boilers at those works.

Q. 92. How do you get along without stirrers?

(Same objection.)

A. There is no necessity for using stirrers in boiling wood, as the wood retains the form in which it is placed in the boiler, thus allowing the convective currents of the alkaline solution to travel freely through the mass and thus keeping up the necessary circulation.

Q. 93. Are you acquainted with the ordinary Spofford boiler?

(Same objection.)

A. I am.

Q. 94. What do you understand to be the difference between that boiler and the one described in the patent to Keen, dated 13th September, 1859?

(Same objection.)

A. The differences are these: From the vertical portion of Keen's boiler, and from the position of the gate or valve at its lower extremity, and from the man-head or charging-hole being placed at the top, it presents great facilities for the charging and discharging of the boiler; and from the heat being applied at its lower end and sides, the heating of the boiler by the natural ascending power of the convective
221 currents is much greater than in a boiler of a horizontal position.

In the Spofford boiler it is usually heated by steam introduced through one of the trunnions, and consequently the absorption of heat by the contents of the boiler takes place from the heating of the upper skin of the boiler which is exposed to the steam, as this heated portion of the boiler in its revolution dips below the liquid contents of the boiler. The passage of the steam through the liquid contents of the boiler near the trunnions of the boiler, if the liquid contents of the boiler are above the trunnion, gives rise to very partial heating of the contents of the boiler, unless long time is employed in boiling. From its rotary motion it is apt to tangle and roll the solid contents of the boiler, if they are long in their character.

Cross-examination continued by Mr. Law, counsel for defendants:

Q. 95. In your answer to the 59th interrogatory, you state that in boiling water, under a steam-pressure of sixty pounds to the inch, the water would be about 310° Fahrenheit. Does not 300° Fahrenheit represent, according to the scale of the French Academy, a pressure of between sixty-six and sixty-seven pounds to the inch?

(Same objection.)

A. In the experiments of the French Academy, I believe that they take the total internal pressure of the vessel in which the experiment was made; that is to say, they do not calculate the fifteen pounds atmospheric pressure, but consider that a vacuum in the vessel represents what in the English mode of computation would be taken as the starting point from which to reckon steam-pressures, and consequently that in all French industrial publications about fifteen pounds should be deducted from their stated pressures. This, with the thermometric errors usually made in calculations of steam-pressures and internal temperatures, accounts for the variation alluded to in this interrogatory. Therefore, 300° Fahrenheit represents, according to the scale of the French Academy, a pressure of somewhere about sixty-six pounds.

Q. 96. What is the difference, if any, between Lardner's scale and that of the French Academy?

(Same objection.)

A. I cannot answer the question off-hand without notes or
222 books, as I never trust to my memory for the endless calculations and figures in physics or chemistry.

Q. 97. Is not Lardner's scale based upon the English mode of computation, which you have referred to in your last answer but one?

(Same objection.)

A. I do not, at the present moment, remember Lardner's scale; neither do I know the date of the Lardner scale referred to, as great improvements have been lately made in the modes of taking pressures and internal temperatures; and consequently all the tables, to a certain extent, vary.

Q. 98. What scale do you use in making your computation, given in your answer to the fifty-ninth interrogatory?

(Same objection.)

A. In the note-book from which I have taken temperatures of solutions corresponding to certain steam-pressures, I have used a table prepared by Professors Cresson and Rand, and myself, as I am not aware that any tables exist in which the temperatures of solutions of varying densities at same steam-pressures exist. These tables were prepared with very great care, and every precaution was taken to prevent error.

Q. 99. The fifty-ninth interrogatory inquires as to the temperature of boiling water, under certain pressure, and has no reference to solutions; can you refer to any published scale, in support of your answer to the fifty-ninth interrogatory?

(Same objection.)

A. The table from which I gave my answer to interrogatory fifty-nine, was also compiled by Proferssors Cresson, Rand, and myself; but it closely coincides with, I believe, Sewell's table, lately published?

Q. 100. Who is Sewell, and when and where was his table you refer to published?

(Same objection.)

A. I do not know who Sewell is. I believe the table is published in one of the hand-books on scientific subjects, published by a London firm, but I do not remember their name.

223 Q. 101. Before you applied for your patent of 1854, you were aware, were you not, that rope and rags had been boiled in alkaline solution under pressure to make paper-pulp?

(Same objection.)

A. I was.

Q. 102. The Spofford rotary boiler was commonly used for that purpose, was it not?

(Same objection.)

A. There was a rotary boiler in use in England, similar to the Spofford boiler, at that time and for that purpose.

Q. 103. Are you not aware that a pressure of sixty pounds was sometimes used in that kind of boiler?

(Same objection.)

A. At that time I was totally ignorant of the amount of steam-pressures used in the rotary boilers referred to.

Q. 104. Have you not since learned that in such boilers a pressure of sixty pounds had been sometimes used previous to the time when you applied for your patent of '54?

(Same objection.)

A. I do not at present recollect ever hearing that, previous to 1854, a pressure of 60 pounds had been made use of in rotary boilers referred to.

Q. 105. In what respect does your re-issued patent, No. 1449, differ from Mellier's patent, dated May 26, 1857, referred to in the bill of complaint in this case?

(Same objection.)

A. The re-issued patent 1449, differs from Mellier's patent above referred to, in that it includes wood and similar vegetable substances, while Mellier's patent is only confined to straw or fibrous material. I consider that the re-issued patent 1449, embraces the Mellier patent above referred to, as I consider straw, &c., a "similar vegetable substance."

Q. 106. If you discovered any new effect produced by a boiling of vegetable substances in an alkaline solution of a specific temperature, please state what is that temperature, and what is the new effect discovered by you.

(Same objection.)

A. In 1853, the new effect I produced by boiling vegetable substances in alkaline solutions was the total removal of the intercellular tissue, leaving the cellulose pure, which, to the best of my belief, had never been previously effected. I found that a definite temperature
224 was necessary to obtain this desired end, this temperature varying with the nature of the vegetable substance being operated upon. For resinous woods, a temperature of the solution of about 372° Fahrenheit was necessary; for non-resinous woods, a temperature of the solution of about 366°; for vegetable substances of a less solid character than wood, a temperature of somewhere about 300°.

Q. 107. In answer to the 67th cross-interrogatory you state you do not consider rags, linen, and cotton ropes to be vegetable substances, within the meaning of the patent No. 1449. How would it be with hemp-rope, hemp, or flax?

(Same objection.)

A. I believe that unbleached hemp-rope and flax come within the category of the vegetable substances included in the patent, provided that the total removal of the intercellular matter is the object arrived at, which can only be effected at a pressure above that equivalent to the lowest limit of temperature mentioned in the patent.

Q. 108. State why you make a difference between cotton-waste and dressed flax, unbleached.

(Same objection.)

A. Because cotton-waste is pure cellulose, contaminated with various matters, and which can be removed by boiling at a moderate temperature in alkaline solutions, while unbleached flax still contains the intercellular matter, binding the ultimate fibres together, and the removal of this intercellular matter requires the alkaline solution to be of a much higher temperature than is necessary for the simple removal of oil and dirt from cotton-waste, as in the former case a decomposition has to be effected, while in the latter a simple saponification.

Q. 109. Suppose a party should take paper-pulp manufactured from hemp, flax, or other vegetable fibres from which paper could be made without any subsequent boiling in an alkaline solution at a temperature above 290°, and should put that stuff into a boiler and boil it in an alkaline solution, under a pressure of seventy-five pounds, would that be treating a vegetable substance within the meaning of the patent No 1449?

(Same objection.)

225 A. It would not.

Q. 110. What is the process used by the complainants at their works to make paper-pulp?

(Same objection.)

A. The removal of intercellular tissue of vegetable substances by caustic alkaline solutions of certain strengths and temperatures, there-

by producing a pure or nearly pure fibre, which constitutes paper-pulp.

Q. 111. Did you, in the year 1854, assist in the application to the Patent-Office for the patent granted to you and Watt in that year, and did you assist in the preparation of the correspondence with the Patent-Office, connected with such application?

(Same objection.)

A. I did.

Q. 112. Look at the paper now shown you, and marked, "Defendants' Exhibit A, K. G. W., examiner, &c.," purporting to be a copy of a letter written by A. B. Stoughton for Watt and Burgess, dated Washington, April 7, 1854, and directed to the Hon. Charles Mason, Commissioner of Patents, and state what you know in reference to such letter, and whether the original was a part of the correspondence with the Patent-Office, in connection with your application for the patent granted to you and Watt in 1854?

(Same objection.)

A. I know nothing relating to such letter, and I cannot say whether the original was a part of the correspondence with the Patent-Office; but I have no doubt it was.

Q. 113. Do you now use, in the works of the complainants, the order and series of processes described and set forth in this letter, marked, "Defendants' Exhibit A," and therein stated to constitute the invention?

(Same objection.)

A. Yes; with certain highly resinous woods we do, with this exception, that we first boil in caustic alkali, under pressure, as mentioned in the patent, and use chloride of lime in solution instead of chlorine, on account of economy; that is to say, highly resinous wood is first boiled, under pressure, in caustic alkali, then subjected to the action of bleaching-powder in solution; again treated with alkali, and
226 subsequently bleached. In old resinous woods, we have great difficulty in obtaining a good color, except by this means. We do not use this process in the order in the letter referred to in non-resinous woods.

Examination resumed Monday, March 25th, 1867. Present, counsel for respective parties.

Q. 114. Have not the complainants made some paper-pulp for packing paper, at their works at Manayunk and Royer's Ford, by boiling chips of wood in an alkaline solution, and then made such pulp into packing paper, without subjecting the material, after such boiling, to the subsequent action of chlorine or its compounds with oxygen, and without again subjecting the material to the action of a weak solution of caustic alkali?

(Same objection.)

A. They have, at Royer's Ford; but, to the best of my belief, they have not done so at Manayunk.

Q. 115. In making pulp from non-resinous wood, for white paper, do you first boil the wood in alkaline solution, then wash, and then subject the stuff to the action of chlorine or its compounds with oxygen, then wash, then subject the material to the action of a weak solution of caustic alkali, and then wash and bleach the material?

(Same objection.)

A. If the non-resinous wood is old and difficult to bleach, we follow the above order; and, in connection with this, I wish to state that, in my answer to cross-interrogatory 113, I ought to have added that, in

old non-resinous woods, we use the materials in the order as set forth in that interrogatory.

Q. 116. How is it with respect to non-resinous woods, not old?

(Same objection.)

A. We only follow that order to a certain extent, that is to say, we do not use the subsequent treatment with weak caustic alkali, and the final treatment with the hypochlorides.

227 Q. 117. Do you commonly use non-resinous woods that are not old?

(Same objection.)

A. We endeavor to get young wood, and usually use young wood.

Q. 118. When did you last use old non-resinous wood, and what proportion of the whole quantity used of such wood has been old?

(Same objection.)

A. To the best of my belief, the last time that the above mode of using caustic alkali, hypochloride, again alkali and bleach, or hypochloride, was about two or three months ago, but as I am little at the mill, I cannot be exact as to time. I don't think we used more than five per cent., or perhaps not as much, of old non-resinous wood at this time. To the best of my belief, I do not think that the whole proportion of old wood has been greater.

Q. 119. Cannot useful merchantable paper-pulp be profitably made from straw by boiling it in a solution of caustic alkali at a temperature less than 290° Fahrenheit?

(Same objection.)

A. To the best of my belief a fair quality of pulp might be produced at this temperature if a considerable quantity of alkali and lime was employed, but the quality of the pulp would not be of a first-class character.

Q. 120. Cannot the pulp made as stated in the last question be advantageously mixed with manilla to make packing-paper?

(Same objection.)

A. I should think it could.

Q. 121. Please refer to your answer to the 49th cross-interrogatory, and state whether a workable pulp cannot be produced from straw by boiling the same in an alkaline solution below the temperature there referred to, and without the aid of very strong solution, and without boiling the same for a great length of time, and so as to be a mercantile success?

(Same objection.)

228 A. I do not think that a "workable pulp," that is to say, a pulp that will make a fair class of merchantable paper, could be produced at that pressure, except a considerable quantity of other fibrous material was mixed with it.

Q. 122. Cannot merchantable paper be made from bamboo or reeds, by boiling the same at a lower temperature than 290° Fahrenheit in an alkaline solution of less than half the strength now used by you in boiling chips of wood?

(Same objection.)

A. I think that a brown paper could be made by boiling bamboo or reed in caustic alkali below 290°, and with the strength of alkali referred to; but my experience is that the paper would not be of a very strong quality.

Q. 123. Look at the material now shown you, and marked "Defendants' Exhibit B, K. G. W., examiner, &c.," and state whether, in your opinion, a workable paper-pulp could be made from that material by

boiling the same six hours at a lower temperature than 290° Fahrenheit in an alkaline solution, of the strength of 6° Baumé?

(Same objection.)

A. I cannot answer this question, because the words "in an alkaline solution of the strength of 6° Baumé" does not give me the absolute quantity of alkali used to the pound of dry vegetable substance.

Q. 124. Suppose the quantity of alkali used is one-half to the pound of dry vegetable substance of that used by you in treating wood-chips?

(Same objection.)

A. I think with that quantity of alkali stated in the last interrogatory, that a brown paper of fair quality could be produced from the material, Defendants' Exhibit B, but am under the impression that the paper would not be of a very strong quality.

Q. 125. Look at the material now shown you, marked "Defendants' Exhibit C, K. G. W., examiner, &c." and state whether, in your opinion, the material, Defendants' Exhibit B, would make this article, Defendants' Exhibit C, by boiling the material, Exhibit B, in an open vessel less than twelve hours in an alkaline solution, in which twelve pounds of caustic soda of commerce is used for sixty-two pounds of the crude dry material, defendants' Ex-
229 hibit B, producing, after washing and bleaching with chloride of lime, forty-one pounds of the bleached material, Exhibit C.

(Same objection.)

A. I think that it is probable that the material, marked Exhibit C, might be produced from the material marked Exhibit B, by the use of the quantity of alkali stated in the last interrogatory, provided that a considerable quantity of bleach-powder was employed and considerable pains taken in the mode of bleaching; but I believe that the greater part of the intercellular matter adhering to the fibre is removed by the oxidizing agency of the bleaching liquors.

Q. 126. Do not the complainants boil wood-chips in alkaline solution, and then, when white paper-pulp is required, proceed to bleach the same by the usual process of bleaching? If not by the usual process of bleaching, then state by what process the bleaching is effected.

(Same objection.)

A. In young wood, after boiling in an alkaline solution, they bleach much in the usual manner.

Q. 127. Do the complainants, after boiling the wood chips in an alkaline solution, follow the directions contained in the patent number 11343, issued to Watt & Burgess, on the 18th of July, 1854, and given in the following passage in said patent: "The shavings are then to be well washed and pressed, and the washing may be saved and evaporated down and burned in a suitable furnace, when they are again available for the same purpose. The damp shavings are now to be exposed to the action of chlorine or the compounds of chlorine with oxygen, till, on a portion being placed in a dilute solution of caustic alkali, the vegetable substance falls into a dark pulpy mass?" (Defendants' counsel puts in evidence a certified copy of the patent referrred to in last question, which is marked "Defendants' Exhibit D.")

(Same objection.)

A. They do not do so at the present mement; but, under certain circumstances, they would employ that process?

Q. 128. Under what circumstances would they employ that process?

(Same objection.)

230 A. If the price of salt-cake rose sufficiently as to reduce the cost of chlorine, the salt-cake being a product of the elimination

of hydrochloric acid, and if the price of manganese fell so that the production of chlorine from the said hydrochloric acid could be cheaply effected so that the compound process could be cheaply conducted, it would be employed.

Q. 129. Do the complainants, after the treatment mentioned or referred to in the last question but one, follow the further directions of the said patent of 1854, as contained in the following passage: "The shavings are now to be placed in a weak solution of caustic alkali, when they will fall into a pulpy mass of a dark-brown color?"

(Question withdrawn.)

Q. 130. Do the complainants, after the treatment mentioned or referred to in the 127th cross-interrogatory, follow the directions of the said patent of 1854, as contained in the following passage: "The pulp obtained as above described, having been freed from the alkali by washing, (which may be saved as before directed,) may now be bleached by the usual process, or, as we prefer, by chlorite or hypochlorite of soda or potash liberating the chlorous or hypochlorous acid by hydrochloric acid?"

(Same objection.)

A. We do, with the exception that we obtain the hypochlorous acid from the hypochlorite of lime, using sulphuric acid or hydrochlyric acid, as is most convenient.

Q. 131. Do you consider that the process now used by the complainants is what you and Watts claimed as your invention, in the following passage in the said patent of 1854: "But what we do claim as of our invention, and desire to secure by letters-patent, is the pulping and disintegrating of shavings of wood and other similar vegetable matter for making paper by treating them with caustic alkali, chlorine, simple or its compounds with oxygen, and alkali in the order substantially as described?"

A. I do.

Q. 132. Why?

(Same objection.)

A. Because, in the first treatment by caustic alkali, boiling under pressure is referred to. We do not limit obrselves to the
231 amount of pressure to be used, and the subsequent processes are now frequently carried out, though we occasionally omit some of them, when, from the character of the material under treatment, it is not necessary to use them.

Q. 133. Did you mean and intend that the claim in the said patent of 1854 for the process therein described for the pulping and disintegrating of shavings of wood and other similar vegetable matter for making paper should include straw boiled in an alkaline solution under high pressure to make white paper?

(Same objection.)

A. We intended to include vegetable substances which would include straw.

Q. 134. Did you mean to include vegetable substances not similar to shavings of wood?

(Same objection.)

A. At the time of my invention, in 1853, I believed I was the only person who had pulped or disintegrated vegetable substances; and by the words "vegetable substances" I intended to include such plants in the vegetable world whose fibres could be converted into pulp for paper-making purposes, by the destruction of their true intercellular matter.

Q. 135. Did you mean and intend that the claim in said patent of

1854 should include straw boiled under a pressure of less than fifty pounds?

(Same objection.)

A. I did; but at a pressure above atmospheric pressure.

Q. 136. Did you mean and intend that the claim in said patent of 1854 should include straw boiled in an alkaline solution, at a temperature of 212° Fahrenheit, in an open vessel?

(Same objection.)

A. Not unless the subseqent treatment described in the patent was employed, as I found that unless considerable pressure was used I could not dispense with the oxidizing agency of chlorine or its compounds with oxygen for the destruction of the intercellular matter; but I considered that I could boil straw at a temperature of 212°, provided I employed the subsequent treatment described in the patent.

232 Q. 137. Did you not know when you applied for said patent of 1854 that paper was then made from straw boiled in alkaline solution in an open vessel?

(Same objection.)

A. I did; but I knew of no process in which the subsequent treatment was carried out when the straw was boiled at 212°, similar to that described by us.

Q. 138. Did you intend to claim a patent for the process of boiling straw in an open vessel in an alkaline solution?

(Same objection.)

A. Not without the subsequent treatment described in the patent.

Q. 139. Does not the patent of 1854 include a boiling, not under pressure, in an alkaline solution?

(Same objection.)

A. It does so, provided that the subsequent treatment therein described is adopted.

Q. 140. If the subsequent treatment described in said patent is not adopted, does that patent include a boiling, not under pressure, in an alkaline solution?

(Same objection.)

A. It does not.

Q. 141. In the claim of your patent of 1854, you use the expression "shavings of wood, and other similar vegetable matter." What vegetable matter do you consider to be similar to "shavings of wood?"

(Same objection.)

A. Substances containing ligneous intercellular matter, binding the true fibre together.

Q. 142. Do you consider flax and hemp to be vegetable matter similar to shavings of wood, within the meaning of the language quoted in the last question from your patent of 1854?

(Same objection.)

A. I consider raw flax and hemp similar to shavings of wood within the meaning of the language quoted, because the ultimate fibres themselves are connected together by true intercellular matter, which, by oxidation, is converted into humic and ulmic acids, precisely similar to the intercellular matter from wood.

233 Q. 143. Do you consider that no one in the United States, after the granting of your patent in 1854, could make paper-pulp or material for paper from straw, flax, or hemp, by boiling the same in an alkaline solution, either in an open vessel or under pressure, without first obtaining an authority so to do under your patent of 1854?

(Same objection.)

A. No, I do not, provided that, in the event of their boiling in an open vessel, they did not use the subsequent chemical treatment described in the patent; or, if they boiled under pressure, in a caustic alkaline solution, they did not use that temperature which is necessary for the removal of intercellular matter which binds the true fibre together.

Q. 144. What is there in the patent of 1854 in relation to such temperature, as referred to in your last answer?

(Same objection.)

A. There is no definite temperature stated in the patent of 1854, because, from my then ignorance of patent-law, I believed that, from mentioning boiling, under high pressure, I was entitled to its use to any extent that I desired, believing that no one at that time had really pulped vegetable substances by boiling in alkaline solutions at a high pressure.

Q. 145. Were you not aware that hemp ropes had been boiled under pressure in alkaline solutions to make paper?

(Same objection.)

A. I was; but I had never seen and never heard of true pulping being effected on rope for paper-making purposes. The ropes, being boiled in comparatively dilute solutions of alkali and lime to remove dirt and certain portions of the intercellular matter, the fibre of this hemp-rope being still strongly cemented together by the intercellular tissue not removed by the boiling, to such an extent that the rag-engine had to be employed for a long time to tear up and open out the hemp fibre, the complete destruction of the intercellular matter being effected by the large quantities of bleach which such rope always requires.

Q. 146. In your answer to the 70th cross-interrogatory you state that, in taking out the re-issued patent of 1863, it was intended that it should apply to all vegetable substances containing ligneous matter, and that you know of no vegetable production that does not contain
234 ligneous matter when it has arrived at maturity. Did you intend, in taking out your original patent of 1854, that it should apply to all such substances to be boiled in alkaline solutions, whether under pressure or in an open vessel?

(Same objection.)

A. I intended, in 1854, in taking out the patent, naturally to include such vegetable substances as I believed would produce paper-pulp.

Q. 147. Knowing, as you did, when you took out your patent of 1854, that straw-paper was then being made by boiling straw in an alkaline solution, did you not intend to take your patent for making paper-pulp from wood by first boiling the wood in a strong alkaline solution, whether under pressure or not, and then subjecting the damp shavings to the action of chlorine, or the compound of chlorine with oxygen, and then placing the material in a weak solution of caustic alkali; and was not the treatment in that order the invention for which you sought to obtain a patent?

(Same objection.)

A. In taking out the patent in 1854, for making paper-pulp from wood, et cetera, by first boiling the wood in a strong alkaline solution, whether under pressure or not, I did intend following the subsequent process to a greater or less extent, according to the amount of alkali and pressure used in the first stage; but I believed that the best pecuniary result would be obtained by boiling with a moderate quantity of alkali under pressure, and the subsequent use of a considerable

amount of chlorine. I am not aware that my knowledge of the fact that straw-paper was being made by boiling straw in an alkaline solution had much weight with me, as I was not aware that the simple boiling of straw in an alkaline solution had been used for the manufacture of paper-pulp, except for common yellow paper.

235 Examination resumed March 26th, 1867. Present, counsel for respective parties.

Q. 148. Is your patent of 1854, or the re-issue of 1863, for any particular quality of paper?

(Same objection.)

A. No; they were not.

Q. 149. Had you any idea when you applied for your patent of 1854, that you could have the right, under that patent, to prevent others in the United States from making paper from straw, manilla, hemp, and flax, by boiling these materials in an alkaline solution without treating them "with caustic alkali, chlorine simple, or its compounds with oxygen and alkali, in the order substantially as described" in your said patent of 1854?

(Same objection.)

A. When I applied for the patent in 1854, I believed that that patent would give me the right to prevent others in the United States from making paper from straw, et cetera, by boiling these materials in an alkaline solution, without treating them with caustic alkali, chlorine simple, or its compounds with oxygen and alkali, in the order substantially as described, provided that the vegetable substances were disintegrated by means of the boiling in an alkaline solution, which could only be done under pressure.

Q. 150. Please refer to your answer to the 106th interrogatory. If you, in 1853, made the discovery mentioned in the said answer, why did you not disclose the same in your patent of 1854, instead of stating therein as follows: "We find boiling in a solution of caustic alkali, under pressure, of considerable service. We do not claim this operation as a part of our invention?"

(Same objection.)

A. Because at the time of my applying for the patent, in 1854, I believed that no one had ever thought of using alkali in boiling under pressure, for the purpose of disintegrating vegetable substances. I thought the idea a perfectly novel scientific fact, and in my ignorance of patent matters at that time, I thought I only had to refer to it
236 to entitle me to its use for the above purpose; but as I knew that boiling, under pressure, as a process, such as the boiling of cotton rags and waste, et cetera, under pressure, for the purpose of destroying the mordants of the dyes, and grease, and dirt, and that a small, close boiler was well known as Papin's digester, I used the words, "we do not claim this operation as a part of our invention;" these words badly expressing the idea I wished to convey.

Q. 151. If you made the discovery which, in your answer to the 106th interrogatory, you say you did, why did you, in your re-issued patent No. 1449, make the following statement: "Boiling in a solution of caustic alkali, under pressure, is of essential importance. By the words, 'under pressure,' is meant a pressure at, near, or above 300° Fahrenheit?" Why did you not state in that re-issued patent what you have stated in your answer to the 106th cross-interrogatory, as follows, "For resinous woods a temperature of the solution of about 372° Fahrenheit was necessary; for non-resinous woods a temperature of the solution of about 366°?"

(Same objection.)

A. Because, in appplying for the re-issued patent No. 1449, the words first quoted in the question appear to me to better cover the temperatures necessary for the disintegrating of vegetable substances when boiling in an alkaline solution, than if I had given definite temperatures, as I had found that the temperature necessary to effect this disintegration greatly varied with the character of the material under operation. I did not wish to confine myself to particular temperatures for any particular vegetable substance, as the age of these substances required varying temperatures.

Q. 152. With respect to the patent obtained by you and Mr. Watt, in England, referred to in your American patent of 1854, have you or any body else ever done anything under that patent in England? Are any works now in operation there under that patent?

(Same objection.)

A. In 1855 or 1856, works were commenced and started under the auspices of Mr. Charles Watt, but owing to disagreements between him and the gentlemen who furnished the means, nothing practical
237 at that time was accomplished. Owing to Mr. Watt's great age the matter has not been able to be resuscitated, though various efforts have been made. To the best of my belief, there are no works in operation, as I have not heard that they have been successful in effecting the necessary pecuniary arrangements.

Q. 153. Do you know that wood paper-pulp, is extensively manufactured in England, to be mixed with rags?

(Same objection.)

A. I do not know that wood paper-pulp, prepared by chemical means is extensively manufactured in England to be mixed with rags, but I have heard that ground wood has been used in England for that purpose.

Q. 154. The wood paper-pulp manufactured by the complainants is commonly mixed with rag-pulp, or some other material, to strengthen it, is it not?

(Same objection.)

A. The wood paper-pulp now manufactured at Royer's Ford is not mixed with any foreign material. That manufactured at Manayunk, for news-paper, has, I believe, about four per cent. of rope; at least, this is the quality I was told they were using when I was last there.

Q. 155. Do you think the pulp shown you, and marked Defendant's Exhibit C, would require any admixture with rags to make good, strong paper?

(Same objection.)

A. I believe such pulp, with proper rag-engine manipulation, could be made into a good quality of paper. I could not say exactly as to its strength until I had seen its behavior in the rag-engine.

Q. 156. If you consider the first claim in your re-issued patent of 1863, No. 1449, to include any invention except what you disclaimed in your patent of 1854, state what it is.

(Same objection.)

A. What I consider was claimed in the first clause of the re-issued patent of 1863, No. 1449, did not include any invention, except the use of boiling vegetable substances in alkali, under pressure, as a process or preparatory process for the manufacture of paper from such vegetable substances.

Q. 157. Is not the second claim in the said re-issued patent confined to a process of treating resinous woods?

238 (Same objection.)

A. The second claim refers to the process of treating resinous woods, but I do not understand that it is strictly confined to those woods.

Q. 158. By whose agency were the re-issues in 1863, the re-issued patents Nos. 1448 and 1449, obtained? Did Mr. Jenckes have anything to do with the applications for these re-issues?

(Same objection.)

A. I consulted Mr. Jenckes during the application for the re-issue of these patents, Nos. 1448 and 1449, during the year 1863. The patents were obtained in connection with myself, Mr. Ladd, and Mr. Keen. To the best of my recollection, Mr. Jenckes was with me in Washington, at the time I searched the Patent-Office, and I advised with him upon the result of such search.

Q. 159. How do you make out that your claim of the use of the chemical processes, and in the order named in the English patent, is the same as you claim in your American patent of 1854, in which nothing is said about the use of sulphurous acid before the boiling in an alkaline solution?

(Same objection.)

A. In the patent of 1853 the compound sulphurous acid process was only a preparatory process and not an essential one, and I saw no reason for retaining it in the American patent of 1854.

Q. 160. Why did you omit from your American patent of 1854, the directions to boil the shavings of wood for some hours in water, in the first stage, and then pass a stream of sulphurous acid through the mass before treating the same with chlorine or chlorous acid, as directed by the English patent to be done before the boiling in alkaline solution?

(Same objection.)

A. Because I did not think the sulphurous-acid process of sufficient value to take the place of the extra expense incurred in its use.

Q. 161. Do you consider that, notwithstanding the omission referred to in your last question, your American patent is for the same invention as that described in your English patent, in which you claimed

239 as follows: "In the above processes we do not confine ourselves to the particular apparatus or utensils herein named, but claim the use of the chemical processes, and in the order herein stated?"

(Same objection.)

A. I do; because the sulphurous-acid process is only alluded to in the provisional specification. It is omitted in the complete specification.

Q. 162. What do you understand to be the invention described and claimed in Keen's patent, dated 16th June, 1863? Do you consider that the invention consists in connecting the man or feed hole in the shell of the boiler with the man or feed hole through the diaphragm, by a perforated well or cylinder, as mentioned in the patent, and in the combination of the arrangement of the discharge pipe and valve with a boiler provided with such perforated diaphragm?

(Same objection.)

A. I consider that the invention consists in a boiler placed vertically with the diaphragm discharge-cock, substantially as described and arranged in the specification.

Q. 163. Is there such a perforated diaphragm and well in the vertical boilers which you saw at the defendants' works?

(Same objection.)

A. I did not see the interior of the boilers at defendants' works and cannot, therefore, reply to the question.

Q. 164. Is there any, and if any what, difference between the arrangement of the discharge pipe and valve described in the said Keen patent, dated 16th June, 1863, and the discharge valve and cock described in Keen's patent, dated 13th September, 1859?

(Same objection.)

A. There is a difference between the arrangement of the discharge-valve described in the Keen patent dated June, 1863, and the discharge valve and cock described in Keen's patent, dated 13th September, 1859; but the model from which the description of the last patent, 1859, was taken, was merely a small tin model made by Mr. Keen to illustrate the general principle of the boiler, and he does not in this patent confine himself to any particular form of discharge-valve. The differ-
240 ence between the two valves is merely mechanical, the one being a slide-valve and the other a cone-valve.

Q. 165. For what length of time have the complainants and those under whom they claim manufactured and sold paper, or paper-pulp, by the process described in the Watt and Burgess patent re-issued in 1863?

(Same objection.)

A. The paper was manufactured by the compound process described in the Watt & Burgess patent in the year 1854, but I believe not sold. It has been regularly sold in the market since 1856. The paper has been manufactured and sold by the complainants under the Watt and Burgess patent, inasmuch as the compound process described in that patent has been from time to time used. We do not generally use it. I should think that we must have used the compound process within six months after the time the complainants came into possession of that patent.

Q. 166. Is there any practicable mode by which the paper-maker can determine the temperature of the liquid in which he boils vegetable substances, under pressure, except by noting the steam-pressure in the pulping-boiler, or in the feed-boiler, making due allowance in the latter case?

(Same objection.)

A. I am aware of none. I refer to a practical operation.

Q. 167. Please refer to Brande's Encyclopædia of Science, published in New York, in 1845, title, Steam Boiler, page 1166, now shown you, and to the table there exhibiting the temperature and corresponding pressure of steam as determined by the experiments of the French Academy, and state whether that table differs from any other table or scale of the French Academy which you have seen.

(Same objection.)

A. I cannot at present recollect if there is any difference, as I very seldom refer to a French scale.

Q. 168. Refer to your answer to the 95th interrogatory, and state whether you find the scale of the French Academy, as published in Brande's Encyclopædia, to be what you stated in your said answer you believed it to be.

(Same objection.)

A. I have examined my answer to the 95th interrogatory,
241 and it appears that the scale of the French Academy, as published in Brande's Encyclopædia, is what I believed it to be.

Q. 169. Does not that table exhibit the temperature 212° to correspond with the pressure of one atmosphere, and is not the temperature of 300° represented there by a pressure of between sixty-six and sixty-seven pounds to the inch?

(Same objection.)

A. In the table referred to, the temperature of 212° corresponds to the pressure of one atmosphere, and the temperature of 300° is represented by a pressure of between sixty-six and sixty-seven pounds, but this table is a translation, and I do not know how the atmospheric pressures correspond to the French mode of estimating them.

Q. 170. Please refer to the same book, page 1163, and see Dr. Lardner's table there, showing in one column the "total pressure in pounds per square inch," and in another column "the corresponding temperature." Does not that scale make sixty-six pounds pressure equivalent to a temperature of 302° Fahrenheit, calculating the atmospheric pressure which you suppose to be omitted in the French calculation?

(Same objection.)

A. I have referred to the said book and find that the total pressure in pounds per square inch of sixty-six pounds is equivalent to a temperature of 302°, but in both of these tables it is the temperature of the steam and not of the water, which is given. This table is not calculated according to the French method. In connection with this matter great and numerous variations and errors have been committed by the various experimenters, owing to the want of care in permitting the pressures to rise before the previous pressure's true temperature is recorded to by the thermometer. Very delicate apparatus is required to estimate this temperature, and a very slow order of experimenting.

Q. 171. Is this hand-book, called "Engineers' and Mechanics' Hand-Book," published by Harper & Brothers, New York, edited by Charles H. Haswell, the hand-book referred to by you in your answer to the 100th interrogatory; and is the table there given from experiments of 242 the committee of the Franklin Institute the table you refered to; and is not the temperature of 298.50° represented there by a pressure of 4.5 atmospheres, and a temperature of 304.50° by 5 atmospheres; and is not 212° there represented by one atmosphere?

(Same objection.)

A. It is not the book which I referred to in my answer to that interrogatory. The table is not the one I referred to. A temperature of 212° is there represented by one atmosphere, and a temperature of 298.5° by 4½ atmospheres; and a temperature of 304.5° by 5 atmospheres. This table also alludes to the temperature of the steam, and not of the water.

Q. 172. Please refer to Miller's Elements of Chemistry, published in New York, in 1864, and look at the table on page 260. Is not the temperature 291.2° represented there by a pressure of 4 atmospheres; and is not the temperature 306° there represented by a pressure of 5 atmospheres; and is not 212° Fahrenheit there represented by a pressure of 1 atmosphere?

A. The temperature in the work referred to in the last interrogatory, of 291.2°, is there represented by a pressure of 4 atmospheres; a temperature of 306° by a pressure of 5 atmospheres, and 212° by a pressure of 1 atmosphere. This table also indicates the temperature of the steam and not of the water.

Q. 173. In your answer to the 55th interrogatory, you state that the words "at, near, or about," were purposely used in the patent. Have you not misquoted the patent, and was not the word "above" instead of "about" purposely used, in order to include a pressure up to 500° Fahrenheit, which would be, according to the scale of the French Academy, a pressure of 45 atmospheres, or about 675 pounds pressure. Did you ever use such a pressure?

(Same objection.)

A. In my answer to the 55th interrogatory, the words used by me "at, near, or about" should have been "at, near, or above;" the word "above" was purposely used in order to include any necessary pressure that we might require, up to as high as 500°. We have never used such pressure.

Q. 174. Look at the paper, the New York Tribune, of date
243 August 21, 1865, marked Defendants' Exhibit D 2, and say whether you consider it to be paper of fair quality and strength?

(Same objection.)

A. I have examined such paper and consider it a paper of fair quality and strength, with the exception that it is rather hard and rattling, which generally indicates that much of the intercellular matter has been removed by bleaching-powders.

Q. 175. Was Mr. Watt, who was the joint patentee with you in your patent of 1854, in the United States, when the applications were made for the two re-issues of that patent in 1863?

(Same objection.)

A. He was not in the United States at that time.

Q. 176. Did he or you, on such applications, or either of them, make oath or affirmation that you were the original and first inventors or discoverers of the value and efficacy of the boiling of vegetable fibrous substances in an alkaline solution at, near, or above a temperature of 300° Fahrenheit?

(Same objection.)

A. I cannot remember at the present time.

Q. 177. Have you, or has the said Charles Watt, at any time, made such oath or affirmation, to be filed in the Patent-Office?

(Same objection.)

A. I cannot remember, at this time, as to that fact.

Q. 178. Has any other person, to your knowledge, ever made such oath or affirmation, to be filed in the Patent-Office, in support of any or either of the applications for patents, or reissues of patents, claimed by the complainants?

(Same objection).

A. I cannot remember, at this date, as to that fact.

(Complainant's counsel here states that he now recalls the witness.)

Q. 179. Look at the instrument now shown to you and marked "Exhibit O, K. G. W., examiner, &c.," and state whether the signature of the said A. P. Harrison, subscribed thereto as witness, is genuine.

A. It is.

244 Q. 180. Look at the instrument now shown to you, and marked by the examiner "Exhibit P, K. G. W., examiner, &c." and state whether you made oath to the facts therein stated, on the 13th day of September, 1858, and whether the same were true at that time.

(Objection by defendants.)

A. I can swear to signing such an affidavit, but cannot say positively the day; but, to the best of my belief, it was on the day mentioned in the interrogatory. The facts stated in the affidavit were at that time true.

Recross-examination by defendants:

Q. 181. In Exhibit P, no date appears when such affidavit purports to have been made. How do you fix the time when you say it was made?

A. Because, to the best of my belief, I signed it before Mr. Munchower, on the day which is attached, and from the fact that it had to be sent to the Patent-Office, in 1858.

Q. 182. Can you state, from your own knowledge or recollection, when the application for that re-issue of 1858 was made?

A. I cannot, except from the date on the affidavit and the date of the year of the re-issue.

HUGH BURGESS.

Sworn before me, on the days which appear in the body of this deposition, and subscribed this 26th day of March, 1867.

KENNETH G. WHITE,
Examiner, &c.

Adjourned to March 27th, 1867, at 11 a. m.

MARCH 27TH, 1867.

Present, counsel for respective parties.
Adjourned to 28th inst., at 11 a. m.

245 Examination resumed, March 28th, 1867. Present, counsel for respective parties.

GEORGE P. NELSON, produced and sworn on the part of the complainants, testified as follows:

Q. 1. What is your name, age, residence, and occupation?

A. My name is George P. Nelson. I am in my fifty-first year; residence, Scarsdale, in the county of Westchester, and my occupation is that of a lawyer.

Q. 2. Have you ever seen a power of attorney executed by Charles Watt, appointing John Watt his attorney to sell a patent for the manufacture of paper from wood?

(Objected by defendants.)

A. I saw such a power of attorney in the year 1854, purporting to be executed by Charles Watt, and to have been acknowledged by him before George N. Saunders, consul of the United States for London and dependencies, with the consular seal attached to the certificate of acknowledgment. That power of attorney was at the time in the possession of John Watt.

Q. 3. Do you remember the contents or the substance of the contents of said power of attorney? If yea, state the same fully and particularly?

(Objection by defendants.)

A. I recollect the substance of the contents of that power of attorney. The substance of it was, that Charles Watt constituted and appointed John Watt his attorney, giving him power and authority to sell his interest in a patent for the manufacture ot paper from wood, ordinarily termed the wood-paper patent, and as his attorney, in case of sale, to make, execute, and deliver, the necessary instrument, assignment or transfer, of the same; and also giving to him, John Watt, a power of substitution and revocation.

Q. 4. Was the said power of attorney sealed.

(Objection by defendants.)

A. It was.

Q. 5. Did you know the said John Watt, in 1854?

(Objection by defendants.)

A. I did, and became very well acquainted with him.

246 Q. 6. Do you know whether the said John Watt did anything and if so, what, under said power of attorney, as the attorney

of said Charles Watt, after the execution of said instrument and before substituting anybody in his place?

(Objection by defendants.)

A. I know that he made negotiations for the sale of the interest of Charles Watt, in that patent, but do not know that any negotiations were concluded before he left for Europe and before he substituted an attorney in his place.

Q. 7. Look at the instrument now shown you, and marked by the examiner "Exhibit O, K. G. W., examiner," &c., and state whether you know A. P. Harrison, whose name is subscribed as witness thereto.

(Objection by defendants.)

A. Yes.

Q. 8. Where is the said A. P. Harrison now?

(Objection by defendants.)

A. He is in the city of New Orleans, and has lived there since prior to 1860.

Q. 9. Have you ever seen the said A. P. Harrison write, and are you acquainted with his handwriting?

(Objection by defendants.)

A. I have seen him write very often, and am acquainted with his handwriting.

Q. 10. Is his signature as a subscribing witness to said instrument genuine?

(Objection by defendants.)

A. It is the genuine signature of A. P. Harrison.

Q. 11. Were you present at the execution of said instrument? If yea, did you see the execution of the same, and did you see the said John Watt sign said instrument?

(Objection by defendants.)

A. The instrument was drawn in my office. The date of the month is in my handwriting. It was executed at my office by John Watt, and in my presence, and Mr. Harrison was with him there and subscribed it as witness, also in my presence. I saw John Watt sign it, and I saw Harrison subscribe his name as a witness to it.

Q. 12. Did you see the power of attorney mentioned in said instrument, at the time of such execution of the same?

247 (Objection by defendants.)

A. I did, and compared it with the dates mentioned in this instrument executed by John Watt.

Q. 13. Examine the paper-writing now shown to you and marked by the examiner "Exhibit Q, K. G. W., examiner," &c., and state whether the same is a correct copy of the said original instrument now shown to you and mentioned in the preceding seventh interrogatory.

(Objection by defendants.)

A. It is. I have examined and compared it with the original, and find it a correct copy.

(Counsel for complainants here offers in evidence the sworn copy, marked Exhibit Q.)

Q. 14. Do you know Hugh Burgess, of Royer's Ford, Pennsylvania? Have you ever seen him write, and are you acquainted with his handwriting?

A. I do know him and have known him for twelve to fifteen years past; I have seen him write and am acquainted with his handwriting.

Q. 15. Do you know Frederick B. Houghton, of England, formerly of the city of New York? Have you ever seen him write, and are you acquainted with his handwriting?

A. I do know him and have known him for a good many years. I have seen him write very frequently and am well acquainted with his handwriting.

Q. 16. Did you prepare an assignment to the said Frederick B. Houghton of letters-patent of the United States, issued to Watt and Burgess, for the manufacture of paper from wood?

(Objection by defendants.)

A. I did prepare such an assignment. Mr. Houghton was my client at the time.

Q. 17. Do you remember the contents or the substance of the contents of said assignment? If yea, state the same fully and particularly.

(Objection by defendants.)

A. I do recollect the substance of that assignment. For the consideration of twenty-five thousand dollars, Hugh Burgess and Charles
248 Watt assigned and transferred to Mr. Frederick B. Houghton letters-patent granted to them by the United States, for certain improvements in the manufacture of paper from wood, and all their right, title, and interest in and to the same, and all matters growing thereout absolutely. The instrument was dated in November—22d November—1854. It also gave the date of the letters-patent, which was the 18th July, 1854.

Q. 18. Were you present at the execution of said assignment?

(Objection by defendants.)

A. I was.

Q. 19. Did you see the execution of said assignment?

(Objection by defendants.)

A. I did.

Q. 20. By whom was said assignment executed?

(Objection by defendants.)

A. It was executed by Charles Watt, by his attorney, Hugh Burgess, and by Hugh Burgess individually.

Q. 21. Were the signatures of said Hugh Burgess to said instrument individually, and as the attorney of said Charles Watt, genuine?

(Objection by defendants.)

A. They were the genuine signatures of Hugh Burgess. I was commissioner of deeds at the time, and it was acknowledged before me by Hugh Burgess, at that time, as attorney for Charles Watt, and for himself individually, and my certificate of acknowledgment was added to it.

Q. 22. Was said assignment sealed?

(Objection by defendants.)

A. Yes, sir; it was.

Q. 23. Did you see the delivery of said assignment to said Frederick B. Houghton?

(Objection by defendants.)

A. I did, sir; it was done immediately after the execution of it by Mr. Burgess.

Q. 24. Were the letters-patent mentioned in said assignment delivered at the same time to the said Frederick B. Houghton?

(Objection by defendants.)

A. Yes, sir; they were. The letters-patent were left in my
249 possession by Frederick B. Houghton, for safe-keeping, for some length of time afterwards; but for how long I cannot state.

Q. 25. Did you see the said Frederick B. Houghton pay, at *at* that time, to the said Hugh Burgess the consideration expressed in said assignment?

(Objection by defendants.)

A. I did.

Q. 26. Have you made any search for said assignment? If yea, with what success?

(Objection by defendants.)

A. I have made very diligent search in my office among all my papers, and I have made such search several times, but have never been able to find it.

Q. 27. State if you know who last had possession of said assignment, and whether the same is now in existence.

(Objection by defendants.)

A. The last that I recollect positively about the possession of that assignment, it was in my possession in my safe at my office; my office was then at 70 Wall street. It has gone from my possession, or at least I cannot find it; whether it is in existence I cannot say; I do not know. I moved my office, five years ago, from 70 Wall street to 55 Liberty street, where it is now. The safe in my office in Wall street was built in the wall, and belonged to the building, and when I moved I had to move those papers from that safe, and my only solution as to the loss of that paper is, that it may have been lost in moving those papers from Wall street to Liberty street. I lost a number of papers at that time.

Q. 28. Did the said Frederick B. Houghton do anything, to your knowledge; and, if so, what, after the execution of said assignment, as the owner of said letters-patent and property under said assignment?

(Objection by defendants.)

A. I know that he made sundry experiments under the patent in making paper, and finally he made a sale and transfer of it to William F. Ladd and Morris L. Keen.

Q. 29. Look at the instrument now shown to you, and marked "Exhibit R, K. G. W., examiner, &c.," and state whether your signature to the same as a subscribing witness to the execution thereof is
250 genuine, and whether you saw the said Frederick B. Houghton execute the same, and whether his signature thereto is genuine?

A. My signature as a witness is genuine. I saw Frederick B. Houghton execute the same and sign his name, and both signatures are genuine.

Q. 30. Read the recital in the instrument mentioned in the last interrogatory now shown to you, and state whether the same is true, to your own knowledge?

(Objection by defendants.)

A. I had in my possession the original patent granted by the United States to Watt and Burgess. I also had, at one time, in my possession the power of attorney executed by Charles Watt to John Watt, for the purpose of drawing the substitution of Hugh Burgess as attorney. I also prepared and had in my possession the assignment of the letters-patent by Charles Watt and Hugh Burgess to Frederick B. Houghton. And after the assignment to Frederick B. Houghton I know of an agreement between Frederick B. Houghton and William F. Ladd and Morris L. Keen, by which Ladd and Keen became entitled to have an assignment of the letters-patent from Houghton. In carrying out that agreement between them this assignment, Exhibit R, was drawn, and executed, and delivered.

Q. 31. What did you do with the power of attorney of Charles Watt, mentioned in your last answer?

(Objection by defendants.)

A. Immediately on executing the substitution of Hugh Burgess as attorney in his place, John Watt took it with him.

Q. 32. At the execution of the instrument, Exhibit R, did you see the indenture therein recited as executed by Charles Watt and Hugh Burgess delivered to the said William F. Ladd or Morris L. Keen?

(Objection by defendants.)

A. I have not any recollection of seeing it then at all.

Q 33. Examine the paper-writing now shown to you, and marked by the examiner "Exhibit S, K. G. W., examiner, &c.," and state whether the same is a correct copy of the original instrument, Exhibit R, now shown to you?

(Objection by defendants.)

251 A. I have examined and compared it with the original instrument, marked Exhibit R, and it is a correct copy of it, and the whole of it.

Counsel for complainants here offers in evidence the sworn copy, marked Exhibit S.

GEORGE P. NELSON.

Subscribed and sworn to before me, this 28th day of March, 1867.

KENNETH G. WHITE,
Examiner, &c.

WILLIAM F. LADD, produced and sworn on the part of the complainants, deposes and saith:

Q. 1. What is your name, age, residence, and occupation?

A. I am fifty-seven years old. I reside at Tarrytown, in Westchester County; am a dealer in watches and jewelry.

Q. 2. Do you know Frederick B. Houghton, now of England, formerly of the city of New York?

A. I do. I have known him for about twenty-five years.

Q. 3. Read the instrument now shown to you, and marked "Exhibit R, K. G. W., examiner, &c.," and state whether you are the person named therein as one of the assignees, and whether the facts therein recited are true, to your own knowledge.

(Objection by defendants.)

A. I am the person named therein. I have read the recital, and the facts stated therein are true.

Q. 4. Were you present at the execution of said instrument? If yea, did you or the Morris L. Keen mentioned in said instrument, to your knowledge, then receive from the said Frederick B. Houghton the indenture recited in said instrument?

(Objection by defendants.)

A. I do not recollect whether I was present.

Q. 5. Did you or the said Morris L. Keen, to your knowledge, ever receive from said Frederick B. Houghton, or have possession of the indenture from Charles Watt and Hugh Burgess to Frederick B. Houghton, recited in said instrument?

(Objection by defendants.)

252 A. I never did receive it, or have possession of it, and Mr. Keen never did, to my knowledge.

Q. 6. Do you not remember whether the assignment now shown to you, and marked Exhibit R, K. G. W., examiner, &c.," was delivered to you or to the said Morris L. Keen? If so, to which one of you was the same delivered?

(Objection by defendants.)

A. It was delivered to me. I do not recollect whether Mr. Keen was present or not.

Q. 7. Did the said Frederick B. Houghton do anything, to your knowledge, and if so, what, as the owner of the letters-patent recited in said instrument, Exhibit R, and of the property granted by said letters-patent, under the assignment to him from Charles Watt and Hugh Burgess, recited in said instrument, after the execution of said assignment and before he disposed of his interest in said letters-patent.

(Objection by defendants.)

A. Frederick B. Houghton, as the owner of said letters-patent, engaged said Morris L. Keen, and erected works and a factory at Gray's Ferry, West Philadelphia, for the purpose of making pulp from wood under the said patent. He offered said patent for sale and endeavored to form a company under said patent. This was about January or February, 1855.

Q. 8. Did you and said Morris L. Keen do anything, and if so, what, as the owners of said letters-patent and property, under said assignment thereof from Frederick B. Houghton, after the execution of the same?

(Objection by defendants.)

A. We erected works at Royer's Ford, Pennsylvania, for the purpose of manufacturing paper and pulp under said patent, which works have been in operation for many years and are in operation at this time.

WILLIAM F. LADD.

Subscribed and sworn to before me, this 28th day of March, 1867.

KENNETH G. WHITE,
Examiner, &c.

253 In the circuit court of the United States for the eastern district of New York.

THE AMERICAN WOOD-PAPER COMPANY }
vs.
THE FIBRE-DISINTEGRATING COMPANY. }

Testimony of Alfred K. Hall, a witness on behalf of complainants, taken pursuant to rule, order, and notice, before Samuel W. Peckham, special examiner, Saturday, the 23d day of February, 1867, at 10 o'clock, at the office of the American Wood-Paper Company, No. 28 Westminster street, in the city of Providence,

ALFRED K. HALL, a witness on behalf of the complainants, having been duly sworn, testifies and says:

Q. 1. What is your name, age, residence, and occupation?

A. Alfred K. Hall; forty-six years; residence, city of Providence; occupation, book-keeper.

Q. 2 Do you know Benjamin Buffum, of the city and county of Providence, State of Rhode Island?

A. I do.

254 Q. 3. Look at the instrument now shown to you and marked by the examiner Exhibit D, and state whether your signature to the same, as a subscribing witness to the execution thereof, is genuine; and whether you saw the said Benjamin Buffum execute the same, and whether his signature thereto is genuine.

A. My signature is genuine. I saw Benjamin Buffum execute the same, and his signature is genuine.

Q. 4. Examine Exhibit D, annexed to the complainants' bill of com-

plaint, and state whether the same is a correct copy of the original instrument now shown you?

A. It is.

Q. 5. Look at the instrument now shown to you and marked by the examiner Exhibit K, and state whether your signature to the same, as a subscribing witness to the execution thereof, is genuine; and whether you saw the said Benjamin Buffum execute the same, and whether his signature thereto is genuine.

A. My signature is genuine. I saw Benjamin Buffum execute the same, and his signature is genuine.

Q. 6. Examine Exhibit K, annexed to the complainants' bill of complaint, and state whether the same is a correct copy of the original instrument now shown to you.

A. It is.

Q. 7. Look at the instrument now shown to you and marked by the examiner Exhibit O, and state whether your signature to the same, as a subscribing witness to the execution thereof, is genuine; and whether you saw the said Benjamin Buffum execute the same, and whether his signature thereto is genuine.

A. My signature is genuine. I saw Benjamin Buffum execute the same, and his signature is genuine.

Q. 8. Examine Exhibit O, annexed to the complainants' bill of complaint, and state whether the same is a correct copy of the original instrument now shown to you.

A. It is.

Q. 9. Look at the instrument now shown to you and marked by the examiner Exhibit P, and state whether your signature to the same, as a subscribing witness to the execution thereof, is genuine; and
255 whether you saw the said Benjamin Buffum execute the same, and whether his signature thereto is genuine.

A. My signature is genuine. I saw Benjamin Buffum execute the same, and his signature is genuine.

Q. 10. Examine Exhibit P, annexed to the complainants' bill of complaint, and state whether the same is a correct copy of the original instrument now shown to you.

A. It is, with this exception, that the following clause, "and in and to letters-patent granted to me, on the 16th day of June, A. D. 1863, for an improved boiler for making paper-pulp," is in the original, but is not in the copy marked Exhibit P.

Q. 11. Do you know or can you set forth any other matter or thing which may be a benefit or advantage to the parties at issue in this cause or either of them, or that may be material to the subject of this your examination or the matters in question in the cause? If yea, set forth fully and at large in your answer.

A. I know nothing further.

ALFRED K. HALL.

Subscribed and sworn to this 23d day of February, 1867, before me.

SAMUEL W. PECKHAM,
Examiner.

256 APRIL, 24, 1867.

Present, S. D. Law, esq., counsel for defendants, and Francis C. Nye, esq., counsel for complainants.

Testimony taken on the part of the defendants, under the sixty-seventh rule of the Supreme Court of the United States.

THOMAS HOWLAND, being duly sworn, deposeth and saith:

Q. 1. What is your name, age, residence, and occupation?

A. Thomas Howland; aged sixty-four; Stockport, Columbia County, New York; paper-maker.

Q. 2. Did you ever use, before the year 1853, a rotary boiler in paper-making?

A. Yes. sir; in the fall of 1852.

Q. 3. When and where was that boiler obtained, and what did you have to do in the getting of it?

A. I obtained it of Goddard, Rice & Co., of Worcester, Massachusetts.

Q. 4. What instructions were given by you, if any, as to what degree of pressure these boilers should be made to stand?

(Objection by complainants.)

A. I ordered it to be made to stand sixty pounds pressure.

Q. 5. For whom was that boiler made; and where was it to be put up; and when was it put up; and how long was it to be used at that place?

A. It was made for Black & Howland, at Fort Edward, Washington County, and was put up there in the fall of 1852, and was used there by us till the 1st of May, 1853.

Q. 6. Was you one of that firm of Black & Howland?

A. I was.

Q. 7. What did you boil in that boiler?

A. Rags, Kentucky ropes, and Kentucky bagging.

Q. 8. What steam-pressure did you use in that boiler?

A. Sixty pounds.

Q. 9. What kind of a boiler, that is, by what name was such a boiler as you had put up there known?

A. They called them Spofford's rotary boilers.

257 Q. 10. Did you see any of the Spofford's rotary boilers in use before you ordered that one for your mill; and if so, where?

A. I should think it was about three years before that I saw one at Spofford's paper-mill, at Willimantic, Conn. There I saw it in full operation.

Q. 11. Was he boiling, or what did he boil in it?

A. He was boiling rags and Kentucky rope.

Q. 12. What is Kentucky rope?

A. It is rope taken off from bales of cotton, made from Kentucky hemp tow. The poorest part of the hemp is the tow full of shives.

Q. 13. When you boiled hemp rope, were you and Spofford the only persons, to your knowledge, who boiled such ropes in such boilers?

A. No; there were a great many other mills that were using such boilers for such purpose, so I was told.

(Last part objected to by complainants.)

Q. 14. Did you use such boiler, or know of such boiler being used to boil cotton-waste?

(Objection by complainants.)

A. We did not use any cotton-waste, but I have seen cotton-waste in such rotary boiler.

Q. 15. What is the effect of sixty pounds pressure in boiling on the seeds of the cotton-waste, and on the shives of the hemp rope and bagging?

A. It softens the shives and the seeds.

Q. 16. What advantage is derived from so softening the shives and the seeds?

A. So that the bleaching powders will bleach them white.

Q. 17. Look at the paper now shown you, (marked Defendants' Exhibit D, K. G. W., examiner, &c.,) and state whether or not the paper of that exhibit was made at Stockport, at the paper-mill of the defendants there.

A. It was made at Stockport by me, and sent to the Tribune office.

Q. 18. What was that paper made from—from what kind of pulp?

A. It was made from pulp sent from the Brooklyn works
258 of the defendants up to me, at Stockport. The pulp was made from bamboo.

Q. 19. How much did it cost per pound of paper for the bleaching liquor with which such pulp, which was made into this paper, (Exhibit D,) was bleached?

A. One cent per pound.

Q. 20. Look at the samples now shown you, and marked Defendants' Exhibits E and F, and state whether papers like those samples were made at Stockport by the defendants; and if so, what such papers were made of.

A. They were made by the defendants at Stockport out of bamboo-pulp, which was sent up from the defendants' works at Brooklyn, and made by me into paper.

Q. 21. In the manufacture, from such pulp, of the paper, (Exhibit E,) state how the quantity of bleaching liquor used compares with the quantity of bleaching liquor required to bleach pulp made from cotton-rags.

A. About the same.

Q. 22. Have you made any paper at Chittenden & Co.'s mill from cane disintegrated by Lyman's steam-blowing process? If so, when did you make it; how did you boil the stuff; and how much alkali did you use in the manufacture?

A. I made at Chittenden & Co.'s mill, in Stockport, paper from cane so disintegrated. I made it just before the war. We put in 5,000 pounds of the blown-stuff into the rotary boiler; then we put in with it 190 pounds of soda-ash, and three barrels of lime, and three or four hundred gallons of water. We boiled it fifteen hours under a pressure of sixty pounds. From that I made the cane-paper.

Q. 23. How did that cane-paper compare with the Defendants' Exhibit E? Was it of a lighter or darker color than that, and how did it compare, as to softness, with that exhibit?

A. It was lighter and softer than Exhibit E.

Q. 24. Will you produce a sample of that cane-paper made by you, marked with your name and the date April 24, 1867, that it may be put into this case as an exhibit, (to be marked as Defendant's Exhibit G?)

A. I will.

259 Cross-examined:

Q. 25. How long have you been in the employ of the Fibre-Disintegrating Company; in what capacity; and where?

A. I commenced there the 1st of January, 1864, as general superintendent of the manufacturing of paper, first at Elizabethport, N. J., and then at Stockport, Columbia County, N. Y. I have continued up to the present time.

Q. 26. Have the defendants manufactured any pulp for paper during your superintendency?

A. They have.

Q. 27. How much have you made for them?

A. I have made no pulp. I superintend the making of that into paper.

Q. 28. How much pulp for paper have the defendants made at Stockport, and how much at Elizabethport?

A. They never made any at Stockport. I cannot say how much they made at Elizabethport; they made some.

Q. 29. How much paper have the defendants manufactured, to your knowledge?

A. I cannot say.

Q. 30. How much short of two thousand tons?

(Objection by defendants.)

A. I cannot say whether it was short or over.

Q. 31. Have they kept constantly at work in the manufacture of paper since you have been at Stockport?

A. No, sir.

Q. 32. What proportion of the time have they been manufacturing paper there?

A. I was there at the manufactory about three months, and then I came to the city and took charge of selling the paper here. While I was there I should think they were not running more than half the time, on account of repairs in putting the mill in order.

Q. 33. Did the greatest quantity of paper manufactured by them at Stockport, while you were there, on any day exceed five tons? If not, how near did it approach that amount?

A. It did not; the greatest quantity was 2,800 pounds.

Q. 34. What was the least quantity?

A. I cannot say.

260 Q. 35. Did the least quantity on any working-day fall below half a ton; and if so, how much, to the best of your belief?

A. It did. I cannot say how much. We might start up and break down, and not run ten minutes.

Q. 36. Who has been superintendent of the mill at Stockport since you left?

A. Mr. Wallace; Thomas Wallace, I believe.

Q. 37. How much paper of the defendant's manufacture have you sold for them since you became their selling agent?

A. I do not know.

Q. 38. Have you sold 1,000 tons? If not so much, state how much less, to the best of your belief.

A. I cannot say whether I have sold a thousand tons or not.

Adjourned to two o'clock p. m., Thursday, 25th instant.

25TH APRIL, 1867.

Present, counsel for respective parties.

Cross-examination of the witness Thomas Howland continued:

Q. 39. What was the largest sale that you have made as selling-agent for the defendants?

A. 103 reams of paper to the Tribune.

Q. 40. Have you often sold as much as that at any one time?

A. Not very often.

Q. 41. You never sold less than fifty reams at a time, did you?

A. I think not.

Q. 42. At what point between fifty and a hundred reams was the average of your sales?

A. I cannot say what the average would be.

Q. 43. Can you swear that it would not exceed seventy-five reams?

A. I cannot.

261 Q. 44. Did you generally sell some paper every day?

A. No, sir.

Q. 45. Did a week ever pass without your making any sales?

A. Yes.

Q. 46. Did two weeks?

A. Yes.

Q. 47. Did three?

A. Yes, sir.

Q. 48. For how many months did you act as selling-agent of the defendants to sell paper of their manufacture?

A. In the neighborhood of a year.

Q. 49. To whom did you sell most of their paper?

A. Satterlee & Lyon.

Q. 50. Did you sell any to any other paper-commission or jobbing house?

A. Yes, sir.

Q. 51. Name such parties to whom you sold.

A. Vernon Bros., Derrickson & Bartlett, Ames & Co., Buckley, Dunn & Co., and a good many others.

Q. 52. Did you sell any to the newspaper publishers? If so, name them.

A. The Tribune was the only one.

Q. 53. Did you sell all of the paper of defendants' manufacture sold by them in the city of New York, or elsewhere, during the period you acted as their selling-agent?

A. I did not.

Q. 54. Who, beside you, sold paper of their manufacture during that period?

A. It was sold from the office, 29 Broadway.

Q. 55. At what price or prices did you sell the paper of the defendants' manufacture?

A. From nine to thirteen cents per pound, according to quality.

Q. 56. You frequently sold some paper every day in the week, did you not?

A. No, sir.

Q. 57. Were you paid by the defendants as their selling-agent, by a salary or by commissions on the sales of the paper?

262 A. By a salary.

Q. 58. Did you ever receive any commission from the defendants for sales of paper?

A. No, sir.

Q. 59. Who was the owner, or who worked Chittenden's mill, when you made paper there just before the war?

A. The mill belonged to R. & G. Chittenden, and was worked by Chittenden & Co.

Q. 60. You acted as general superintendent of that mill, did you not?

A. It was under my general superintendence as one of the partners of the firm of Chittenden & Co.

Q. 61. Who composed the firm of Chittenden & Co.?

A. Robert Chittenden, George Chittenden, and Thomas Howland.

Q. 62. For how long did Chittenden & Co. work their mill in the manufacture of paper?

A. Three years.

Q. 63. For how much of that period did they boil their material under pressure with soda-ash, lime, and water?

A. All the time.

THOMAS HOWLAND.

Subscribed and sworn to before me, this 25th day of April, 1867.

KENNETH G. WHITE,
Examiner.

JOHN P. TOWNSEND, being duly affirmed, on the part of the defendants:

Q. 1. What is your name, age, residence, and occupation?

A. John P. Townsend; forty-three; 167 East Eighteenth street, New York; have no occupation at present.

Q. 2. Have you been in the employ of the defendants as superintendent of their words at Red Hook, Brooklyn? If so, when and how long did you act in that capacity?

A. I acted in that capacity over one year from the 1st August, 1865.

263 Q. 3. Did you make paper-pulp at those works? If so, state what kind of pulp you made there during the last six months of the operations there, and from what material such pulp was made. Was the material subjected to any and what process or processes before being treated with any chemicals?

A. We made what paper-makers term half-stock. During the last six months I think we made some paper also. It was made, some of straw and some of bamboo. The straw was not made into paper; it was only made into half-stock. The bamboo or straw was first put into vats and soaked. It was then put into guns, and 170 pounds pressure to the square inch given it—that is to say, from 165 to 170 pounds—and was then discharged into the gun-room. It was then taken and put into an open boiler and boiled in spent alkali. It was then put into the beating-engines, washed and cleaned. It was then pumped up into a receptacle to drain. From thence into the closed boilers; and there the chemical was given it, and it was boiled under pressure.

Q. 4. During the last six months that you were there, after the stuff had been treated in the beating-engines, how long was it boiled in the closed boilers under pressure, and under what pressure?

A. Four hours under pressure; at a pressure not below forty pounds and not above sixty pounds.

Q. 5. Why or how came you to use so low a pressure as forty pounds?

A. By order of the president.

Q. 6. Was it found that the upright boilers in use there, in which the stuff was boiled, would not bear a pressure of sixty pounds, and for that reason, among others, was a less pressure used and ordered?

(Objection by complainants to form and substance.)

A. Yes. We did not deem it safe to keep sixty pounds pressure on them.

Q. 7. Did you find that the stuff boiled was treated as effectually at fifty pounds pressure as at sixty?

A. Yes.

Q. 8. On that fact being proved or found out, did Mr. Russell give any, and if so, what directions as to using a still lower pressure than fifty pounds?

264 (Objections by complainant; also to form.)

A. He did; he gave orders to use forty pounds.

B. 9. How long was that before the works at Red Hook were closed?

A. I should say from four to six months.

Q. 10. Were these directions of Mr. Russell followed?

A. Yes, implicitly.

Q. 11. Did you find any difference in the material, whether boiled under forty or sixty pounds pressure?

A. Apparently no difference.

Q. 12. What was the chemical solution in which you say you boiled the stuff, and what was its strength, and what do you estimate the cost of the chemical used per pound of paper made, as you have stated, during the last four to six months of the running of these works at Red Hook?

A. The solution was caustic alkali, mostly the foreign crystal. There were two classes used, some we made on the premises. The two classes were not used at the same time. It would average about twelve degrees Baumé to the pound of the dry crystal. We used five thousand degrees to three thousand pounds of dry stock as it came from the beating engine. As near as I can remember, the cost of the dry crystal would average about eight cents a pound; that would be about two-thirds of a cent to a degree.

Q. 13. What do you estimate to be the quantity of paper made from three thousand pounds of the dry stuff treated as you have stated?

A. There was a shrinkage of about thirty per cent.; there would be over two thousand pounds of paper.

Q. 14. Is there a Spofford rotary boiler in the defendants' works at Brooklyn? If so, was it used to boil any of the same stuff which was boiled in the upright boilers?

A. There is such a boiler that was so used.

Q. 15. Did you use in that rotary boiler the same or different pressure and chemicals from that used in the upright boilers?

A. We used the same chemicals and the same pressure.

Q. 16. Is or was there a stirrer in one of the upright boilers used there? If so, describe it, and state when such stirrer was last used.

265 A. There was a stirrer in both of the upright boilers. We took the stirrer out of one of the boilers from eight to ten months previous to the works being closed. I cannot tell exactly the time. We did not use the stirrer in the other boiler for about four months before the closing of the works. The works were closed the 1st of August, 1866. I do not think there was any pulp made from about the 16th to the 20th of July. The stirrer was a propeller on an upright hollow shaft extending twenty-eight inches from the shaft. The stirrer in each boiler was made the same.

Q. 17. Why did you discontinue the use of the stirrer?

A. Because we esteemed them more plague than profit.

Q. 18. How were such upright boilers loaded or charged? Was there a perforated diaphragm in such boilers, and is the man or feed hole in the boiler connected with a man or feed hole through the diaphragm by a perforated well or cylinder, so that the material can be charged through said well into the boiler without falling upon or clogging the perforated well or diaphragm?

A. We charged them on the upper quarter. There was a perforated diaphragm situate above the man-hole plate. We charged the boiler below the diaphragm.

Adjourned to Friday, at 11 o'clock, a. m., 26th inst.

FRIDAY, APRIL 26TH, 1867.

Present, counsel for respective parties.

Cross-examined:

Q. 19. What quantity of bamboo in the dry stick was requisite to produce three thousand pounds of the dry stuff or stock as it came from the beating-engine?

A. It is only by estimate that I can answer that. I cannot answer it positively. I suppose there was about 40 per cent. shrinkage.

Q. 20. And there was a shrinkage of about 30 per cent. on the dry stuff or stock as it came from the beating-engine, in making the same into paper, was there?

A. Yes. That I made as an estimate, not carrying it all the way through into paper myself.

266 Q. 21. But to the best of your knowledge and belief those two percentages of 40 and 30 are correct, are they?

A. I believe they are, and I think them rather above than below the amount of shrinkage.

Q. 22. Were the shrinkages the same during the whole of the last six months in which the mill was in operation under your superintendence?

A. There was no variation, as far as I know.

Q. 23. Was there any difference in respect of those shrinkages between bamboo and straw?

A. I could not answer that question. We made none of the straw that was blown into paper. There was only a small quantity of the straw any way.

Q. 24. Was the shrinkage on the straw, taken before soaking and cleansing, 40 per cent. in making it into dry stuff or stock as it came from the beating-engine?

A. The straw was made into half-stock without going into the heating-engine at all. I do not know what the shrinkage would be or was.

Q. 25. Was the straw put into the open boiler and boiled in spent alkali?

A. Yes.

Q. 26. What was then done with it?

A. It was put into the pressure-boilers and there boiled, under pressure, with clear alkali.

Q. 27. What was next done with it?

A. It was blown out of those boilers, under pressure, and washed, and then removed as half-stock.

Q. 28. It was sent up to Stockport, Columbia County, New York, to be there manufactured by the defendants into paper, was it not?

A. I think it was.

Q. 29. You mean it was sent there for that purpose when it was removed as half-stock?

A. Yes.

Q. 30. What quantity of straw was requisite to produce, as you treated it, a hundred weight of half-stock?

A. I do not know that I can say.

267 Q. 31. What was the shrinkage on the bamboo as discharged from the pressure-boilers in the form of pulp in manufacturing it into paper?

A. Ten per cent., I think, was the estimate. I think I may say from five to ten. This was what I heard from others.

Q. 32. Then the shrinkage on the bamboo as dry stuff or stock in making it into pulp, as discharged from the pressure-boilers, was from 20 to 25 per cent., was it?

A. Yes.

Q. 33. And the total shrinkage on the bamboo taken in the stick was from 52 to 55 per cent. in making it into pulp, was it?

A. From my experience I think that correct.

Q. 34. What was the quantity of the solution of caustic alkali of the strength of 12° Baumé to the pound of the dry crystal which you had in mind in giving the strength of the solution, in your answer to the twelfth interrogatory?

A. We would take a pound of the dry crystal and put it into a gallon of water and it would average 12° Baumé. It would fluctuate according to the quality of the crystal. That is a fair average.

Q. 35. Then the average strength of the caustic alkaline solution which you used in the pressure-boilers was such that a pound of the dry crystal would test 12° Baumé to the gallon of water, was it?

A. I suppose it would test higher. We did not use it as gallons, but only recokoned it by degrees. For instance, to 3,000 pounds of dry stock we put 5,000° of alkali, without any reference to the number of gallons.

Q. 36. By dry stock, in your last answer, do you mean the bamboo as it came from the beating engine?

A. Yes; the bamboo as it came from the beating-engine, dried.

Q. 37. What were the dimensions and capacities of the two upright boilers in which you boiled the dry stock or straw, under pressure, in a solution of caustic alkali?

A. I never measured them; have been told they were eight feet diameter and sixteen feet high. I do not remember their computed capacity.

268 Q. 38. Were those two boilers so nearly alike that you could not distinguish them? If not, by what convenient designation can you or did you distinguish them?

A. I believe they were exactly alike. We designated them as No. 1 and No. 2 egg-boilers.

Q. 39. Did you fill to its capacity each of those boilers every time you charged them for boiling the dry-stock or straw?

A. Yes; they were filled as full as we could conveniently. We intended to fill them with uniform weight.

Q. 40. How many pounds of the dry-stock or straw did each charge of those boilers consist of?

A. It was three thousand pounds weight.

Q. 41. Do you affirm to that amount from your own unaided recollection, or do you make the statement as you find it in the report or memoranda to which you have referred?

A. I make it from my own estimate.

Q. 42. Then you refer to those minutes or memoranda merely to refresh your recollection, do you?

A. Yes.

Q. 43. And when you said, yesterday, in your direct examination, that you used 5,000° of the caustic alkaline solution to 3,000 pounds of dry-stock, as it came from the beating-engine, you had just before refreshed your memory by those minutes or memoranda, and then made that statement from your own recollection. Did you do so?

A. Yes; I referred to them as memoranda that I had made at the mill daily, and I remembered in examining them. They were my records.

(Counsel for complainants here requests permission to inspect the memoranda referred to by the witness, which have been placed by him in the hands of counsel for defendants, for the purpose of cross-examining the witness therefrom, which is refused by defendants' counsel.)

Q. 44. How many gallons of the solution of caustic alkali did each charge of those boilers consist of?

A. I do not remember. We reckoned it by degrees and not by gallons.

Q. 45. Do you believe there are any entries in the memoranda,
269 to which you have referred, by which you might refresh your recollection so as to be able to affirm to the approximate number of gallons.

A. I think there is in part; though we never reckoned it in that way. I always reckoned it by degrees.

Q. 46. State the approximate number of gallons, to the best of your belief.

A. I should think about 20° Baumé to the gallon, and that would make 250 gallons.

Q. 47. What was the foreign crystal which you used in making the solution of caustic alkali?

A. It was the ordinary crystal of commerce.

Q. 48. Do you mean it was what is known to the trade as commercial caustic soda?

A. I do.

Q. 49. State the mode you used in preparing the solution of caustic alkali as put into the pressure-boilers from the commercial caustic soda.

A. We simply dissolved it in hot water.

Q. 50. What did you dissolve in it, and how did you get it from that vessel to the alkali-boilers?

A. We dissolved it in an iron tank, and we drew it from the tank through pipes into the boilers.

Q. 51. What were the dimensions of this iron-tank, and where were the pipes fitted to it?

A. I think they were seven feet high, and five feet in diameter. There were two of them. The pipes were fitted into the bottom. They were screwed into the bottom.

Q. 52. Were these tanks placed in an elevated position above the man-holes of the alkali-boilers, or was there a curvature in the pipes near their junction with the tanks?

A. They were placed above the man-holes. I do not think the pipes were straight. I think there were three or four elbows in them.

Q. 53. What was the composition of that solution of caustic alkali which you made on the premises?

A. Soda-ash and lime and water.

Q. 54. Were those the only components?

A. Yes.

Q. 55. Where did you procure the lime?

270 A. It was Glenn's-Falls lime. There is a large lime district there, and it is put into barrels, and sent to the market here.

Q. 56. What was the relative proportion of soda-ash and lime used by you to produce a gallon of the solution?

A. We used half as much lime as we did soda-ash.

Q. 57. How much soda-ash did you use?

A. We used different quantities. If we took a pound of soda-ash to the gallon of water, it would mark on the Baumé 10 degrees; but I think the average, as near as my memory serves me, is light.

Q. 58. Could you refresh your recollection by referring to the memo-

randa you have referred to so as to affirm more precisely as to the quantities, strength, and their limits?

A. I think not. It would only give numbers of degrees.

Q. 59. Describe the mode of preparing soda-ash, lime, and water in making the solution; the vessel in which it was made, and the mode of injection into the two alkali-boilers.

A. We put in the soda-ash into iron open boilers, and dissolved it by hot water; then we made the lime into a milk of lime, in a wooden vessel, above the boiler in which we dissolved the soda-ash, and run that into the boiler that had the soda-ash in it, and boiled the whole for an hour. We then draw it off, as we wanted to use it, in the pressure-boilers. The open iron-boilers were the same as those used with the crystal alkali.

Q. 60. How many degrees of the solution of caustic alkali made from soda-ash and lime, and how many gallons of that solution did you have in each charge of the alkali-boilers?

A. We used the number of degrees that we did with foreign caustic; but as to the gallons, I cannot state their number.

Q. 61. What was the average strength of the solution made from soda and lime that you used, taking a gallon of the solution to a pound of the soda-ash and lime?

A. As near as I remember it was 8° Baumé as an average. Sometimes it would run up to 11°. The lime would not make it mark any higher on the glass.

Q. 62. What was the average strength of the solution of caustic alkali made from soda-ash and lime as injected into the alkali boilers, and between what limits would such solution range in different charges of the boilers?

271 A. I should think it would range from 13° to 20° on the glass. I cannot state the average, because it would vary so. If we should put a certain number of pounds of soda-ash to-day in a certain number of gallons of water it might test a number of degress less or more than the same number of pounds and the same number of gallons would test to-morrow, because of the different strengths of the soda. I always used degrees in the place of gallons, that there might be no error.

Q. 63. Between what limits did the solution of caustic alkali, made from the foreign crystal range in different charges of the boilers?

A. I should say from 18 to 25 degrees Baumé. The pound of crystal would vary from 9 to 19 degrees Baumé, when dissolved in a gallon of water. This variation was owing to the impurity of the crystals.

Q. 64. Had each of the upright boilers a perforated diaphragm?

A. Yes.

Q. 65. What was the purpose of this diaphragm?

A. To keep the pulp from going up the steam-inlets.

Q. 66. Then the boilers were heated by steam, were they?

A. Yes.

Q. 66. And the ends of the pipes, through which the steam was introduced into them were above the diaphragms, were they?

A. Yes.

Q. 68. Was the steam introduced into these boilers directly into the expansion chamber above the diaphragm, and did it thence exert a pressure upon the contents of the boiler, or were there pipes through which the steam was passed without its coming in actual contact with the contents of the boiler?

A. It was introduced into the top of the boiler over the diaphragm

and into the boiler below the diaghragm by a separate pipe, and into the bottom of the boiler by another pipe. The steam exerted a pressure on the whole boiler from the lower pipes as well as from the upper one above the diaphragm. There were pipes through which the steam could pass, but we did not use them. There were five entrances for steam into these boilers—four below the diaphragm.

272 Q. 69. Then, in practical operation, the steam came from the pipe by which it was introduced into the boiler, directly in contact with the contents of the boiler, except that introduced by the pipe above the diaphragm, did it?

A. Yes, it did; but frequently, I suppose, the liquor was above the diaphragm, when it was expanded into steam by the heat.

Q. 70. Describe the manner in which the steam was introduced into the boilers from the four lower pipes.

A. The pipes were screwed into an ordinary stuffing-box. The steam went from the lower pipes down across the cock. I think the lower inlet of that steam was three feet above the discharge-cock. I am speaking now of the two lower entrances; they dipped down so as to keep the mouth of the cock clear. The two lower pipes entered the boiler at the junction of the egg and upright portion of the boiler; they then curved down along the egg portion of the boiler to right over the discharge-valve. The two upper ones came in at about the same position at the top of the boilers; they just went through the boiler.

Q. 71. Was steam introduced into the boilers through the two lower pipes that opened over the discharge-valves during all the four hours or more of the boiling?

A. Yes, usually.

Adjourned to Saturday, 27th inst., at 11 o'clock a. m.

APRIL 27*th*, 1867.

Present, counsel for respective parties.

Cross-examination continued:

Q. 72. What was the size of these five pipes?

A. I think four of them were an inch in diameter, and I think one was an inch and a quarter; those four might not have been more than three-quarters of an inch, come to think of it. Those four were the four lower ones. The bore was uniform in each of the five.

Q. 73. At what rate or rates was the steam introduced into the boilers?

A. The boiler that we fed from usually had sixty-five pounds
273 pressure; and when we got up to our requisite pressure, which was indicated by a gauge and also by a safety-valve, we then shut off our boiler to keep the pressure below, so that the safety-valve would not raise on the pressure-boiler, and opened the doors in the steam-boilers to stop their making steam, or at least only enough to keep up the pressure to forty pounds on the pressure-boiler.

Q. 74. What pressure did the steam-gauge on the alkali-boilers indicate after you had got up to the requisite pressure?

A. Forty pounds.

Q. 75. But it varied, did it not; and if so, between what limits did it range?

A. I do not know that it varied.

Q. 76. State the time when you began to limit the pressure to forty pounds, or thereabouts.

A. As near as I remember, it must have been in October or November, 1865.

Q. 77. But previously to that you had used a pressure that was indicated on your steam-gauge by fifty pounds, had you not?

A. For a short time; I should not think it would exceed two weeks.

Q. 78. And previous to the use of that pressure indicated by fifty pounds, you had used a pressure indicated by sixty pounds on your steam-gauge, had you not?

A. Yes.

Q. 79. For how long was the pressure, indicated by sixty pounds on the steam-gauges attached to the alkali boilers, used by the defendants at their mill, in Brooklyn?

A. I cannot say exactly; I should think it must be about a year, though I do not think the boilers were in constant use for that length.

Q. 80. Are they any entries of the pressures indicated by the steam-gauges on the alkali-boilers in the memoranda to which you have referred to refresh your recollection in some of your previous answers?

A. No, not that I am aware of.

Q. 81. Can you affirm positively that there are none?

A. Yes.

274 Q. 82. You say there were memoranda made by you at the mill daily, and were your records; what did those memoranda relate to, and to whom do they now belong?

A. A daily record of stock used, amount of labor, what was received, as tools or machinery that came into the mill, as coal that came into the mill; that is all I think of now. They are my private memoranda that I made for the mill, and they are in the possession of the company. They belong to the company.

Q. 83. How did they come into your possession, when you referred to them on your direct and cross-examination?

(Objection by defendants, as assuming that the witness referred to such memoranda on his direct examination, when it does not appear as a fact that he did.)

A. I think they were given me by William P. Arnold, at my request, some three months ago, and I did not refer to them or take them out on my direct examination.

Q. 84. Had you kept possession of them ever since you received them from Mr. Arnold?

A. Yes.

Q. 85. Is Mr. Arnold the secretary of the Fibre-Disintegrating Company, the defendants?

A. Yes.

Q. 86. Then they remained in your possession until you gave them to defendants' counsel, after answering cross-interrogatory No. 43, did they?

A. Yes.

Q. 87. What do you mean by "stock used" in your answer to cross-interrogatory No. 82?

A. I mean the number of discharges of the guns, the number of discharges of the pressure-boilers, the number of degrees of alkali used, the number of pounds of iron used in the blacksmith shop, the number of pounds of coal used; it included the number of pounds of half-stock made. The memoranda did not reach back to the time when we made paper. They included the number of pounds of foreign crystal and soda-ash used.

(Counsel for complainants again requested permisson of defendants' counsel to inspect the memoranda referred to by the witness. Counsel for defendants has not those papers inquired of in his possession,
275 and cannot therefore produce them. The objection to their pro-

duction however, as he understands it, is that the papers embraced refer to many experiments, made under the direction of the president of the defendants, which have no reference to and are not connected with any inquiries made of the witness, and which experiments are not of a public character, and are not intended to be made public. Counsel for complainants requests their production for his inspection of those parts of the memoranda to which the witness referred. Counsel for defendants states that they are not in his possession. He will consider the request of complainants' counsel and give reply thereto.)

Adjourned at 11 o'clock, Monday, April 29th, 1867.

APRIL 29, 1867.

Present, counsel for respective parties.

Cross-examination continued:

Q. 88. Where were the gauges attached to the alkali-boilers, and how did the steam act on them?

A. As near as I remember they were attached about the centre. They were attached with pipes, like all other gauges.

Q. 89. Did the opposite end of the pipe at which the steam entered open into that part of the boiler which was above the diaphragm?

A. Below.

Q. 90. Was the pipe straight or was the gauge brought down so as to be conveniently read?

A. The pipe was not straight, but the gauge was brought down so as to be conveniently read.

Q. 91. How near to the diaphragm did the pipe enter the boiler?

A. Probably six feet below.

Q. 92. How far below that point was the gauge brought down?

A. It might have been two feet, or it might have been one.

Q. 93. How much of pipe connected with the steam-gauge entered the boiler?

A. I can't say. I never was inside of the boiler.

276 Q. 94. Do you not know whether the pipe merely went through the iron of the boiler or extended into the boiler?

A. I do not.

Q. 95. How far from the boilers was the place to which the steam-gauge was attached?

A. I never measured it. I should suppose it was about eighteen inches.

Q. 96. Do you affirm, of your own knowledge, that the opposite end of the pipe connecting the steam-gauge and the alkali-boiler to that which entered the gauge was not above the diaphragm of the boiler?

A. I am very certain it was not; and the reason I am certain of it is, that we used to get pulp in it occasionally, and had to clean it out.

Q. 97. How did you clean the pipes connecting the gauges with the alkali-boilers when they became clogged up with pulp?

A. Sometimes we could blow it out by opening the cock below the gauge, and sometimes by removing the gauge.

Q. 98. How long was the pipe, and to what extent did it become clogged by the pulp?

A. I should think it might have been from four to five feet long, and it might have become clogged once a week or once a month.

Q. 99. It was clogged up to the gauge when you removed the gauge to clean it, was it not?

A. Not necessarily at all.

Q. 100. Where was the safety valve attached to the alkali-boiler?

A. On the top end of the boiler.

Q. 101. At what pressures were the safety-valves on the alkali-boilers set to blow off?

A. Never below forty pounds, and never above sixty.

Q. 102. When you boiled at a pressure indicated on your steam-gauge by sixty pounds, they were set to blow off at sixty, were they?

A. Yes.

Q. 103. Did they ever blow off?

A. Sometimes, if we happened to get the pressure a little too high.

277 Q. 104. Were they always set to blow off at a particular number of pounds during the time you boiled at a pressure indicated on your steam-gauge by forty pounds?

A. Yes.

Q. 105. Were your steam-gauges or your alkali-boilers ever tested except by the city authorities after they were attached to the boilers?

A. They were tested by the Government authorities. They were not tested by any one else that I am aware of.

Q. 106. From what boilers did you feed your alkali-boilers with steam?

A. We fed from any one of four sets that we desired to feed from.

Q. 107. Name those four sets.

A. No. 1 was what we called the Cornish boilers; there were two of them. No. 2 was three tubular boilers. No. 3 was Harrison's boiler. No. 4 was three plain cylinder boilers.

Q. 108. What boiler or boilers did you feed your steam-gun or cylinder from?

A. Sometimes No. 3, and sometimes No. 4. Those two sets were put up expressly for that use.

Q. 109. When you fed your steam-guns or cylinders, and your alkali-boilers from set No. 3 or set No. 4, what pressures did your steam-gauges on those sets indicate?

A. When we fed the guns they indicated from 165 to 175 pounds. When we fed the alkali-boilers it would run from 60 to 85 pounds to the square inch. And the reason that we had to keep so high a pressure was that those sets of boilers was so far away there was some condensation of steam in the passage to the boilers. Those boilers were not put up to supply steam to pulp with. The boilers that were put up to pulp with were close by, and we never carried over 60 pounds on them. (Last part of answer objected to by complainants.)

Q. 110. Which set of boilers did you usually feed your alkali-boilers from?

A. In the last four months we fed almost exclusively from the Harrison boiler.

Q. 111. Previously to that time, which set did you usually feed from?

278 A. From No. 2.

Q. 112. You sometimes fed your steam-guns and alkali-boilers from the Harrison boiler, set No. 3, at the same time, did you not?

A. No. They were not fed on the same day from the same set.

Q. 113. Were the boilers from which the defendants at their mill at South Brooklyn fed their alkali-boilers, ever connected with, or the same as the boilers with which they at the same time fed their steam-guns?

A. No.

Q. 114. You mean, in your last answer, that the boilers were never

connected; or the same during the time you were at the mill, do you?

A. They were never connected at the same time while I was there. I refer to the time when I was there.

Q. 115. How many men had you under you whose business it was to take care of the alkali-boilers?

A. I had one to superintend that department. He had under him five men. We used to call him Nick.

Q. 116. It was Nick's business to superintend the charging and discharging of the boilers, and to watch the gauges and safety-valves, was it?

A. Yes.

Q. 117. Did you watch the gauges and safety-valves on the alkali-boilers during the boiling?

A. I usually knew the pressure they were under; and I ordered the chief engineer, also, always to know what pressure they were under.

Q. 118. And after giving your orders, you left it to the chief engineer and Nick to watch the pressures during the boiling, did you?

A. Yes.

Q. 119. What kind of gauges were those used by you on the alkali-boilers?

A. Bates' patent. They were spring-gauges.

Q. 120. You say the purpose of the diaphragm in the alkali-boilers was to keep the pulp from going up the steam-inlets. What inlets do you refer to, and was this the only purpose?

279 A. I refer to the large inlet at the top. It was not the only purpose, but was also to keep stuff below the surface of the liquor.

Q. 121. Was the diaphragm stationary; and, if so, how made stationary?

A. It was stationary, and was fastened to the main boiler.

Q. 122. Had the man or feed hole of the alkali-boilers ever been at the top above the diaphragm?

A. No.

Q. 123. What was the width of the blade of the stirrer of your alkali-boilers? Did it extend on both sides of the shaft?

A. I think the width of the outer end was about eleven inches; next to the shaft about four. It extends both sides of the shaft alike.

Q. 124. Did the shafts ever have more than one blade or blades? If so, how many?

A. There was one shaft to a boiler, and two blades on that shaft; they were two propellers, the shaft passing through the centre of them.

Q. 125. How far apart on the shafts were these two propellers?

A. They might have been six feet.

Q. 126. Describe the discharge cock and valve of the alkali-boilers, and the mode of working them.

A. It is what is known as a plug-cock. I could not specify whether it was four or six inch. It was worked by a mitred gear.

Q. 127. Was there a pipe in the bottom of the boiler through which you discharged the contents of the boiler, and in which the cock was placed?

A. No; the cock was directly attached to the boiler.

Q. 128. Did you discharge the contents of the boiler under pressure?

A. Yes.

Q. 129. Did you manufacture any of the pulp discharged from the alkali-boilers into white paper, at South Brooklyn?

A. Not whilst I had charge.

Q. 130. Then you made nothing but brown paper during the year you were there, did you?

A. That was all.

280 Q. 131. How much of the pulp turned out by you was made into paper at South Brooklyn?

A. I cannot say. We might have made paper there three months. For a time I had charge of making the paper.

Q. 132. How much pulp did you make at defendants' mill at South Brooklyn?

A. I could not say.

Q. 133. Please produce samples of the paper and pulp manufactured by you at defendants' mill.

A. I have not got them to produce.

(Defendants' counsel states that the samples of blown bamboo, pulp, &c., referred to by the witness on his direct examination, will be produced and put in evidence, but that the defendants wish to produce them upon the redirect-examination of the witness.)

Q. 134. What process did you subject the pulp discharged from the alkali-boilers to in manufacturing into paper?

A. It was washed and cut up in the engine and then run into paper.

Q. 135. What was it washed in?

A. Water.

Q. 136. Were any chemicals applied to it?

A. Nothing but sizing and glazing. This is not known as a chemical, though there is a little chemical in it, if you use a vegetable sizing.

Q. 137. How often did you use the rotary Spofford boiler in boiling bamboo or straw?

A. We might have used it a month in the twelve that I was there.

Q. 138. Did you use the same solution of caustic alkali in the rotary boiler as in the two upright boilers?

A. Yes.

Q. 139. From what boiler did you feed the rotary boiler with steam?

A. From any one of the four sets.

Q. 140. What was the pressure on the boilers from which you fed *from* when you fed the rotary boiler?

A. When we fed from No. 2, it was 60 pounds; when we fed from 3, it was from 60 up to 85 pounds. We never fed it from one.

281 Q. 141. What number did you usually feed it from?

A. From number 2.

Q. 142. Between what limits did the pressure or rotary boiler range as indicated by its steam-guage, when you boiled in it?

A. From 40 to 60 pounds. We carried pressure on it the same as on the upright boilers.

Q. 143. Did the safety-valve ever blow off on the rotary boiler?

A. Yes, I believe it did.

Q. 144. At what number of pounds was the safety-valve on the rotary boiler set to blow off?

A. The same as on the others; not below 40 nor above 60.

Q. 145. When you boiled in the rotary boiler at a pressure indicated by its steam-gauge at 60 pounds, what pressure did the steam-guage on the feeding-boiler indicate?

A. Our No. 2 indicated 60; No. 3, 65 to 70. It was not boiled more than half a dozen times with steam from No. 3.

Q. 146. You never used the rotary boiler if you could help it, did you?

A. No.

Q. 147. But its use, such as it was, covered the whole year you were there, did it?

A. It was only in the first part that we used it.

Q. 148. To whom did you sell the paper you manufactured at Brooklyn?

A. I could not say.

Q. 149. Did you give samples of paper and paper-pulp to parties who visited the mill at Brooklyn?

A. I did to those who had letters from the president or dirctors.

Q. 150. And you told such parties what such samples were made from, did you?

A. Yes.

Q. 151. Did you show such parties over the mill and explain to them your mode of operation?

A. Yes, when desired by the president or directors.

Q. 152. Did you manufacture paper-pulp and paper in the first six-months you were at the mill?

282 A. We manufactured paper-pulp, and a part of the time paper. I cannot say how much of the time.

Q. 153. In what respects did your manufacture, during the first six months you were there, differ from that during the last six months, except those you have stated?

A. In the first six months we boiled our blown material in spent alkali, in an open boiler, and then took it out and drained it and put it into the pressure-boilers and gave it clean alkali without washing. In the second six months, the most of the time I think we did not boil in spent alkali, but we washed in water, and then put it in the beating-engines, and there washed and cleansed it. It was then pumped up into a receptacle and drained and then was put into the pressure-boilers, and was given the clean alkali, and boiled under pressure.

Q. 154. Did your operations in the manufacture of paper-pulp and paper differ in any other respects in those two periods?

A. I do not think they did.

Q. 155. Then your operations in the manufacture of paper-pulp and paper were substantially the same during the year you were at the mill, except in those respects you have stated, were they?

A. Yes, I believe so.

Q. 156. What did you do at the mill in the first six months, when you were not manufacturing pulp and paper?

A. We manufactured all the time, except it may be a day or two at a time, when the mill was out of order, or something of that kind.

Q. 157. Did you boil the straw that you used by substantially the same process, the same solution, and the same pressure as the bamboo?

A. Yes.

Q. 158. Then there was no difference in your manufacture whether you had straw or bamboo under process, and what you have stated applies equally to both, does it?

A. Yes.

(Defendants' counsel refuse to produce the memoranda referred to in answer to cross-interrogatory 43, and complainants' counsel re-
283 quests to know the ground on which the refusal is made. Defendants' counsel state that complainants' counsel are not entitled to the production of the paper.)

Re-direct examination:

Q. 159. Look at the sample now shown you, marked "Defendants' Exhibit H, and state whether it is a sample of the bamboo treated by the defendants at their works at Brooklyn, as you have previously stated?

A. Yes, this is a sample of the stick.

Q. 160. Was the bamboo put into the steam-guns in the same condition as the sample referred to in your last answer, or was anything done to it before it was put into the gun? If so, state what was done to it.

A. It was soaked in water and then put into the gun.

Q. 161. Look at the sample now shown to you, marked Defendants' Exhibit I, and state what it is.

A. That is steam-blown bamboo as it comes from the gun.

Q. 162. Look at the sample now shown to you, marked Defendants' Exhibit K, and state what it is?

A. This is the blown bamboo washed and cleaned in the beating-engine. That is all that has been done with it since it came from the gun.

Q. 163. Is that the kind of stuff you put into the alkali-boilers to be boiled in caustic alkali, under pressure?

A. Yes.

Q. 164. Look at the sample now shown to you, Defendants' Exhibit B, and state what it is.

A. That is some of the blown-bamboo, washed by hand.

Q. 165. Look at the sample now shown to you and marked Defendants' Exhibit L, and state what it is.

A. This is the bamboo after it is blown and washed and boiled in the alkali-boilers, under pressure, in defendants' boilers at Brooklyn, and is what we term half-stock.

Q. 166. Look at the sample now shown to you and marked Defendants' Exhibit M, and state what it is.

A. It is the same as sample "L," picked open by the machine to mix with fur for making hats.

Q. 167. With respect to the pulp that was sent away from the works at Brooklyn to be made into paper, can you say, of your own knowledge, what paper was made from that pulp, so as to prove samples of the same?

284 A. No.

Q. 168. Please refer to the printed pamphlet now shown you, and read the eighth interrogatory put to Mr. Hugh Burgess, a witness for the complainants in this case, and also read the answer to that interrogatory, and state whether Mr. Burgess has, in that answer, correctly stated what he says you told him on the occasion to which he refers in that answer. If not, please state in what respect his said statement is incorrect.

(Witness being shown the printed pamphlet containing testimony in the case for the complainants, witness says:)

A. He is incorrect. First, in stating the quantity of lime used. He states that I said the quantity of alkali and lime was the same. I used half the quantity of lime that I did of soda-ash. Secondly, he is incorrect in respect to the solution of alkali. The 2,500 gallons of alkali which he speaks of was mostly spent alkali, and about the quantity of liquid that we used for a charge in the two upright boilers. He speaks of it as being a charge for one, while in fact it was a charge for two.

Q. 169. What was the difference, if any, between the pulp from the rotary boiler and the pulp from the upright boilers?

(Objection by complainants.)

A. The only difference that I am aware of was, that the pulp from the rotary boiler was all knotted up.

Q. 170. Were the upright boilers sufficient for the boiling of the material which you had the means of treating and sending away?

(Objection by complainants.)

A. Yes, after it was washed.

Q. 171. Was the machinery for making paper removed from defendants' works at Brooklyn to be put up at their mill at Stockport? If so, when was that change made?

A. Yes, it was removed, and I should think in April, 1866, but I am not certain.

Q. 172. Do you know whether the paper-making machinery so removed from Brooklyn to Stockport was put up there as proposed, prior to the stoppage of the works at Brooklyn, or were the arrangements of the defendants for working that mill only partly completed?

285 (Objection by complainants.)

A. I understood that the machinery was not put up. I understood that the arrangements for working the mill were only partially completed.

(Objection to answer by complainants.)

Q. 173. Were the defendants' works at Brooklyn completed, as designed by them, prior to the stoppage of those works, or was the machinery or apparatus in an incomplete condition, so that they could not treat large quantities of stuff, nor treat it as they desired and intended to do?

(Objection by complainants; also to the form.)

A. They were incomplete. They were able to make only about three tons of pulp per day. They were preparing to turn out about fifteen.

Q. 174. Was it the object of the defendants to make paper on a large scale, or was their principal object to supply vegetable fibrous substances, disintegrated by the steam-blowing process, to paper-makers, for them to make into paper?

(Objection by complainant.)

A. It was to supply stock to paper-makers. That paper was made more for the purpose of showing what the stock would make than for sale in the market.

Q. 175. Has the use of the steam-blowing process been recently resumed? If so, where?

(Objection by complainants.)

A. I understood it has, at Elizabethport.

Adjourned to 11 o'clock, April 30th, 1867.

286 APRIL 30, 1867.

Present, counsel for respective parties.

Re-direct examination continued:

Q. 176. You say that the stuff boiled in the rotary boiler is curled. What causes it to be curled?

A. In consequence of the rotary motion of the boiler.

Q. 177. If an agitator in the upright boilers would work easily, and without causing any trouble, would you use it, or do you consider the agitator to be detrimental to the operation of boiling?

(Objection by complainants.)

A. I would not use it. As far as my experience has gone, it is better without it than with it. I do not think the agitator is of any service.

Q. 178. If the stuff boiler in the rotary boiler were ground in a Jordan engine, would the knots in the pulp be cut up so as to make the pulp in good condition, ready to run upon the paper machine?

(Objection by complainants.)

A. Yes.

Q. 179. Please refer to your answer to the 12th interrogatory, and say whether you made that statement from your own recollection.

A. I did.

Q. 180. Please read the entry you referred to, and hand in a copy of it.

A. I have read, and this is a copy of it, and I hand it to the examiner.

Q. 181. Suppose the complainant, instead of putting chips of wood into their boilers, were to put into them the stuff, a sample of which you have spoken about, (Defendants' Exhibit K,) would there be any saving of alkali and steam-pressure? If so, to what extent, in your opinion?

(Objection by complainants.)

287 A. I should think there would be a saving of at least two-thirds of the alkali. I don't know as I could say about the steam-pressure, for I never used over sixty pounds. I do not suppose it would be necessary to use over forty pounds.

Q. 182. Suppose the blown and cleansed bamboo fibre to be put into the boiler dry, and pressed, how much paper-pulp could be made for a charge of one of the upright boilers at Brooklyn?

(Objection by complainants.)

A. I should think you could put in 10,000 pounds of the dry, pressed stuff. I don't think it would shrink over thirty per cent.

Q. 183. How would the pulp made from the fibre (Defendants' Exhibit K) compare with the wood-pulp which you have seen, and which was represented to have been made at Manayunk?

(Objection by complainants.)

A. The pulp made from Exhibit K would be much stronger.

Recross-examination:

Q. 184. There was no difference, was there, so far as you know, between straw and bamboo, in respect of shrinkage, as you made them into half-stock?

A. I could not say that there was any difference. I never made enough of straw to learn.

Q. 185. In charging your alkali-boilers, you put in some gallons of spent alkali, did you? If so, how many?

A. Yes, we used spent alkali. We used from one thousand to twelve hundred gallons to an egg-boiler charge.

Q. 186. The stirrers were in constant use until about ten months and four months respectively before the mill closed, were they not?

A. I think that I may have used those stirrers for a month after I became superintendent. Then, some three or four months before the works closed, Mr. Russell wanted I should put that stirrer that was left in this boiler in operation, as he thought it would make a difference. I think we used that two boilings at that time; and we could not see any difference, and we did not use it after that.

Q. 187. Please produce samples of the following kinds of paper-pulp and paper manufactured by defendants at South Brooklyn, namely:

288 Bamboo-pulp or half-stock produced by cleansing, blowing in steam-gun, boiling in open boiler in spent alkali, cleansing in a beating-engine, draining and boiling in a close boiler, discharging therefrom and washing; straw-pulp or half-stock produced by same process; bamboo-pulp and straw-pulp produced respectively by same process, and when the boiling was carried on at a pressure indicated on

your steam-guage by forty pounds and sixty pounds, respectively; bamboo-paper manufactured from pulp produced by same processes; bamboo-paper manufactured from pulp produced by same processes, except the boiling in spent alkali in the open boiler.

A. I have not got such samples.

(Counsel for complainants requests the production of such samples of defendants' counsel. Defendants' counsel has no such samples in his possession; if complainants desire the same, they have power to issue subpœnas duces tecum, to such persons as they suppose have them.)

Q. 188. Look at the sample marked Defendants' Exhibit L, and state whether it was produced by boiling at a pressure indicated on your steam-guage by 40 or by 60 pounds?

A. I cannot answer from my own knowledge.

Q. 189. Please produce the writing paper from which you read in giving your answer to the 168th re-direct interrogatory?

A. I have not got it; I put it in my vest pocket, and have lost it.

Q. 190. In whose handwriting was that memorandum?

A. In my own.

Q. 191. When did you make it, and what was the occasion of your making it?

A. I think it was last Friday, 26th instant. I made it in consequence of R. W. Russell's calling my attention to what Burgess swore to, and he asked me if it was correct. I said to him, no; and he asked me wherein it was wrong, and I told him wherein it was wrong, and I made that memorandum.

Q. 192. Is the entry to which you referred in your answer to the 180th re-direct interrogatory the same memoranda to which you had previously referred, or has it been detached from those memoranda? If it has been detached, state by whom; and had the memoranda been in your possession since you delivered them to defendants' counsel upon making your answer to the 43d cross-interrogatory, until you
289 received the entry in giving your answer to the 180th interrogatory? If they have not been in yonr possession, state from whom you received the detached entry.

A. It is the same memoranda; I detached it from the other memoranda. It was a leaf of the memoranda which I had in my hands the other day, and which I detached from it this morning. They were not in my possession until this morning. I detached the entry myself. I did not receive it from any body.

Q. 193. How came you to detach the entry?

A. In order to roll it up and pin it so that complainants' counsel could read.

Q. 194. State the whole occasion of your detaching the entry.

A. I have stated it.

Q. 195. From whom did you receive the memoranda this morning?

A. I took it out of W'm P. Arnold's bundle of papers.

Q. 196. What conversation have you had with anybody in reference to those memoranda since they were called for by complainants, and with whom? State particularly the conversation relating to their production by you.

(Objection by defendants.)

A. I do not know that I have had any conversation with anybody except W'm P. Arnold. I don't know but I may have spoken to R. W. Russell about them. I don't know why they should not let them see them. The entry that I referred to, Mr. Arnold said they were willing that that entry should be read, and I then detached it and folded it up so as it could be read.

Q. 197. Then you pinned up and folded up yourself this part of the memoranda, so that nothing could be read but that part, a copy of which you have handed in, did you?

A. Yes; I folded it up and then handed in the copy.

Q. 198. Who pinned it up?

A. W'm P. Arnold.

(Complainants' counsel again calls upon defendants for the memoranda in the condition in which they were referred to originally by the witness, and for the unpinning and unfolding of the part last re-
290 ferred to by him. Defendants' counsel refuses to produce the same, and insists that having produced to complainants' counsel the original, and having furnished to him a copy thereof of all that the witness referred to in his examination, that he is not required to produce anything more, or submit any papers of the defendant beyond that to the inspection of the complainants or their counsel.)

JOHN P. TOWNSEND.

Subscribed and affirmed to before me, this 30th day of April, A. D. 1867.

KENNETH G. WHITE,
Examiner, &c.

Defendants' counsel put in evidence—

Copy of an English patent, No. 1922, A. D. 1792, granted Hector Campbell for the manufacture of paper, and marked Defendants' Exhibit 1.

Also, copy of English patent to Mr. Cunningham, 1794, marked Exhibit 2.

Also, copy of English patent to John Trumbull, j'r, 1800, marked Exhibit 3.

Also, copy of English patent to Matthias Koops, 1801, marked Exhibit 4.

Also, copy of English patent to James V. Desgrand, 1838, marked Exhibit 5.

Also, copy of English patent to George R. D'Harcourt, 1838, marked Exhibit 6.

Also, copy of specification of English patent to Morton Balmanno, 1838, marked Exhibit 7.

Also, copy of specification of English patent to Edward Cooper, 1838, marked Exhibit 8.

Also, copy of specification of English patent to John Small, 1838, marked Exhibit 9.

Also, copy of specification of English patent to Miles Berry, 1839, marked Exhibit 10.

Also, copy of specification of English patent to Lemuel Wellman Wright, 1843, marked Exhibit 11.

Also, copy of specification of English patent to Moses Poole, 1844, marked Exhibit 12.

291 Also, copy of specification of English patent to John T. Coupier and M. A. Charles Mellier, 1852, marked Exhibit 13.

Also, copy of American patent to Watt & Burgess, reissue of 1858, October 5, marked Exhibit 14.

Also, copy of American patent to William Magaw, of July 19, 1830, marked Exhibit 15.

Also, copy of American patent to Wooster & Holmes, of August 3, 830, marked Exhibit 16.

Also, copy American patent to J. T. Coupier and M. A. C. Mellier, of August 2, 1853, marked Exhibit 17.

Also, copy of American patent to George Spofford, (John Campbell, assignee,) of June 12, 1850, marked Exhibit 18.

Also, copy of correspondence, &c., connected with grant of American patent to Watt & Burgess, of July 18, 1854, marked Exhibit 19.

Also, copy of correspondence, &c., connected with grant of American patent, re-issue to Watt & Burgess, (Ladd & Keen, assignees,) re-issue No. 608, marked Exhibit 20.

Also, copy of correspondence, &c., connected with grant of American patent granted M. L. Keen, September 13, 1859, marked Exhibit 21.

Also, copy of correspondence, &c., connected with grant of re-issued letters-patent to Ladd & Keen, assignees of Watt & Burgess, April 7, 1863, marked Exhibit 22.

Also, copy of correspondence, &c., connected with grant of re-issued letters-patent to Ladd & Keen, assignees of Watt & Burgess, April 7, 1863, marked exhibit 23.

(Objection of complainants to admission of each and every of the foregoing exhibits, marked 1 to 23, both inclusive.)

LEMUEL WELLMAN WRIGHT, being duly sworn as a witness on the part of defendants, deposeth and saith:

Q. 1. What is your name, age, residence, and occupation?

A. Lemuel Wellman Wright; seventy-seven years of age; reside at 186 Clinton street, Brooklyn, and am a mechanical and civil engineer.

Q. 2. Did you ever have a bleaching mill at Stockport, England? If so, state when you had such a mill, and what you bleached there.

(Objection by complainants.)

292 A. I had a mill at Stockport, Cheshire County, England, for bleaching various fibrous substances, such as cotton-cloth and yarns, linen-cloth and yarns, and threads. This was commenced about 1839.

Q. 3. Are you a native of England?

(Objection by complainants.)

A. No. I was born at Plainfield, Sullivan County, N. H.

Q. 4. In bleaching, as you have stated, did you boil the materials to be bleached in caustic alkali solutions, under pressure? if so, what pressure did you use?

(Objection by complainants.)

A. I boiled them in caustic alkali solution, under pressure from 40 to 80 pounds.

Q. 5. Are you the person named in letters-patent granted in England in the year 1843 for machinery or apparatus for bleaching fibrous substances and manufacturing the same into paper?

A. I am.

Q. 6. In your said patent, in declaring the nature of your invention you mention the peculiar apparatus or machinery employed for the purpose of boiling fibrous substances, straw, jute, wood, &c., by high-pressure steam. Did you have any boilers made to bear high-pressure steam in the boiling of straw? If so, what degree of steam-pressure?

(Objection by complainants.)

A. I had boilers made for such purposes at different places. They were warranted to bear 100 pounds pressure, and I suppose they would have borne two or three hundred.

(Objection to answer by complainants.)

Q. 7. Have you made any paper from straw according to the process indicated in and described by the patent? If so, when and where did you make such paper? Please produce a sample or samples, if you are able to do so.

(Objection by complainants.)

A. I did make paper from straw, according to the process described in that patent. The first paper I made was made at a place in North Wales, called Hope Mills, near Gresford. That was between '42 and '43. This was straw-paper. The next place was St. Mary's Mills, formerly St. Mary's Monastery, in Chalford, Gloucestershire County,
293 about fifteen miles from Gloucester City. It was old Friar Bacon's place. The samples produced, marked Defendant's Exhibits, N, O, P, are papers made from straw-pulp, made by me at Chalford, about 1848.

(Objection by complainants to answer.)

Q. 8. Was the straw from which the paper was made (samples of which you have produced) boiled in caustic alkali, under steam-pressure? If so, what strength of alkaline solution did you use, and what steam pressure?

(Objection by complainants.)

A. The straw was boiled under high pressure, and in caustic alkaline solution. The alkaline solution was of a strength of about 8°, marked by the hydrometer, by such instruments in use at that time; that means 8° in density above water. The steam-pressure used was from 40 to 80 pounds.

Q. 9. Did you, at the great exhibition of the works of industry of all nations in London, in the year 1857, exhibit specimens of paper made by you, as you have before mentioned, from straw?

(Objection by complainants.)

A. I did, and I got a prize-medal.

Q. 10. Have you exhibited similar specimens in any national exhibition in Paris? If so, when, and at what exhibition; and did you so exhibit at the request of the British government? If so, can you produce a copy of any communication in writing containing such request?

(Objection by complainants.)

A. I delivered specimens to Dr. Lyon Playfair, who was instructed by the British government to apply to me for specimens to be exhibited in the exhibition held at Paris, in 1855. The paper annexed, marked Defendants' Exhibit R, is a copy of the original note sent me by Dr. Lyon Playfair, by order of "the lords of the committee of the privy council for trade." I furnished specimens of straw-paper to Dr. Playfair, as requested.

Q. 11. Did you, in your said process, empty the boiler as directed by your said patent, by the pressure of steam on the top of the pulp
294 in the boiler; and was there a space in the top of the boiler for the steam, as shown in the drawing in the patent?

(Objection by complainants; also to form.)

A. I discharged the boiler, as specified in the patent, and there was a space in the top of the boiler for the steam, as shown in the drawings attached to the patent. The steam-space occupied nearly one-third of the capacity of the boiler. It was not a rotary boiler, it was an upright boiler.

(Objection to last part by complainants.)

Q. 12. Have you seen the upright boilers at the works of the defendants at Red Hook, Brooklyn? Do you know anything about the making of these boilers? If so, state what you know about them.

A. I have seen the defendants' upright boilers at South Brooklyn, but I have not seen the inside of them since they have been there. While in England I was applied to by a man named J. Burroughs Hyde for drawings for defendants' boilers, which I gave him, which were set up first at Raritan, N. J.

Q. 13. Was there an opening at the bottom of the boilers through which to discharge the contents by the pressure of steam in the boiler?

(Objection by complainants; also to form.)

A. In the drawings there was provision made in the bottom of the boilers for an opening for discharging, the same as in the drawings of the English patent; but I never saw the bottom of the defendants' boilers since they were made.

Q. 14. When you were working the paper-mill at St. Mary's did you know a Frenchman named Mellier, and did he visit your said mill? If so, for what purpose?

(Objection by complainants.)

A. Two Frenchmen by the name of Muller and Mellier visited the St. Mary's mill, that was my mill at the time, for the purpose of inspecting and understanding the process of making paper from wheat-straw. That was the kind I always used. I sold out St. Mary's mill about 1845, and their visit was previous to that time.

Q. 15. Did you show them the mill, and explain the process to them?

(Objection by complainants.)

295 A. I did, pretty thoroughly, with a view of selling my patent in France, to Muller and Mellier.

Q. 16. Did you sell your patent for France to Muller and Mellier, and make an assignment of it to them; and was your French patent, if one was obtained by you, for the same invention as is described in your English patent; and for how much did you sell your French patent to them?

(Objection by complainants; also to form.)

A. I obtained a French patent. The specification and drawings were the same as the English. I entered into an agreement to sell it to them for £6,000. I sold it to them, and they were to pay for it in certain times, but became bankrupt, and did not pay me.

Q. 17. Did you take out an American patent for the same invention; and if so, when?

(Objection by complainants.)

A. I took out an American patent for the same invention some year or two after. I can't remember the year.

LEMUEL W. WRIGHT.

Subscribed and sworn to before me, this 30th day of April, 1867.

KENNETH G. WHITE,
Examiner.

296 EXHIBIT A. H. S., No. 6.

The wood upon which it is intended to operate by this process should first be reduced to very fine shavings, the finer the better; this may be done by any suitable machine.

The shavings should then be boiled in caustic alkali of the strength indicated by about 12 of the English hydrometer. This process is much better performed under pressure, after the wood has been boiled for about 24 hours, but we do not confine ourselves to this time, as it varies with the nature of the wood and amount of pressure, and it should be well washed and squeezed to remove all the alkali.

It is then placed in a chamber furnished with racks about nine inches

apart, upon wbich the wood is placed and exposed to the action of chlorine or any of the compounds of chlorine with oxygen however obtained. The wood should be exposed to the action of chlorine or its compounds with oxygen until it assumes an orange color and falls into a pulpy mass on the addition of caustic alkali.

The following plan we find to be a convenient and economical means of obtaining chlorine.

A certain quantity of chloride of calcium is to be mixed with the quantity of chromic acid necessary for the mutual decomposition of chlor. calcium and chromic acid, which latter acid may be prepared from rough chromate of potash or soda, or the residue from bleaching of palm-oil or tallow with chromic acid. This mixture is then heated, when a large quantity of chlorine is given off. The mass is to be heated to dryness, which is best done in clay gas-retorts till no more chlorine is given off. The mass, which is now composed of chromite of lime and chloride of chromium, should be powdered and placed on an iron plate exposed to a cherry-red heat. This may be done in a retort, taking care that there is a supply of atmospheric air brought to play upon or through the powder. This heat must be continued till the powder turns of a yellowish-brown color, when it may be removed and placed in a tank containing a sufficient quantity of H. cl. to com-
297 bine with the lime. The mixture may be gently heated, when chloride of calcium is formed and free chromic acid. This may be again placed in the chlorine retort and heated, when a further supply of chlorine is obtained. This process may be repeated till most of the chromic acid is converted into chloride of chromium. When this takes place, which it may do after three treatings with H. cl. acid as above described, the mass containing the chloride of chromium should be dissolved in water, mixed with the necessary quantity of milk of lime, until a precipitate, which should be dried and heated to a cherry-red, when the chlorine will be given off. The resulting mixture may be again treated as above described.

When the wood has been sufficiently acted upon by chlorine or its compounds with oxygen, it is to be removed from the gasing-chamber, and the H. cl. with which it is saturated which is formed by the action of the chlorine, is to be removed with water, and the wood pressed so as to remove as much of the water and acid as possible. After all the acid has been removed from the wood it is to be placed in a suitable vessel, and a weak solution of caustic alkali poured upon it so as to cover it, when the wood falls into a pulpy mass of a dark brown or almost black color. This part of the process may be expedited by having a heater or engine working in the tank or vessel in which the alkali is placed. The alkali in this and the former process should be all saved and evaporated down by any waste heat from the boiler or retort furnace and reburnt, when it may again be used for the same purposes. The pulp, after being well washed, has now to be bleached. This may be done in the usual way, or we prefer to add a certain quantity of chlorite of soda, called also hypochlorite, and liberating the hypochlorous acid by dry H. cl. The quantity of chlorite of soda can only be learned by experience.

298 In the circuit court of the United States for the eastern district of New York.

THE AMERICAN WOOD-PAPER COMPANY
vs.
THE FIBRE-DISINTEGRATING COMPANY. } In equity.

Stipulation of counsel referred to on page 64.

It is hereby stipulated and consented by and between the undersigned, respectively, solicitors and of counsel for the parties to the above-entitled cause, that Kenneth G. White, esq., clerk of the circuit court of the United States for the southern district of New York, be and he is hereby authorized, to take the depositions of Charles Heaton, a witness on the part of the complainants in said cause, and of such witnesses on the part of said complainants as they may produce to testify
299 in support of their title to the patents set forth in the bill of complaint in said cause; said depositions to be taken under the sixty-seventh rule as amended, and to be read in evidence on the hearing of said cause, with the same effect as if taken by one of the examiners of the circuit court of the United States for the eastern district of New York, or an examiner specially appointed by said court; the examination of said witness to take place at the office of said Kenneth G. White, esq., in the city of New York, and to commence on Saturday, the 23d day of February, inst., at twelve o'clock, noon, and to proceed as said examiner shall order.

S. D. LAW,
Solicitor for Defendants.
FRANCIS NYE,
Solicitor for Plaintiffs.

Dated New York, February 20, 1867.

300 EXHIBIT O.—K. G. W., *Ex.*

Know all men by these presents, that I, John Watt, the attorney for Charles Watt, duly appointed by the said Charles Watt, by an instrument in writing, under the hand and seal of the said Charles Watt, and bearing date the third day of March, in the year of our Lord one thousand eight and fifty-four, acknowledged before George N. Saunders, consul of the United States of America for London, on the tenth day of March, in the year of our Lord one thousand eight hundred and fifty-four, in pursuance of the power authorizing me to substitute any person or persons to act under or in the place of myself, as attorneys for the said Charless Watt, in all or any of the matters particularly set forth in said instrument—

Do substitute and appoint Hugh Burgess, now in the city of New York, to act under or in my place as attorneys for the said Charles Watt, in all or any of the matters specified and set forth in the instrument in writing, hereinbefore mentioned; and to which said instrument, for greater certainty, reference is hereby made.

In witness whereof I have hereto set my hand and seal this ninth day of May, in the year of our Lord one thousand eight hundred and fifty-four.

(Signed) JOHN WATT. [L. S.]

Witness:
A. B. HARRISON.

301 EXHIBIT P.—K. G. W., *Ex.*

The United States Patent-Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the files of this office.

In testimony whereof I, T. C. Theaker, Commissioner of Patents, have caused the seal of the Patent-Office to be hereunto affixed, this seventh day of November, in the year of our Lord one thousand eight hundred and sixty-six and of the Independence of the United States the ninety-first.

[SEAL.] (Signed) T. C. THEAKER.

COUNTY OF CHESTER,
State of Pennsylvania, ss:

Before the subscriber, a justice of peace, personally appeared Hugh Burgess, who, being duly sworn according to law, deposeth and saith that he is the Hugh Burgess, who, in connection with Cha's Watt, were the inventors and patentees of an "improvement in the manufacture of paper from wood," which was patented to them in England, on the 19th day of August, 1853, and in the United States, on the 18th day of July, 1854; that this deponent, for himself and as the attorney of Charles Watt, did assign to Fredreick B. Houghton, then of New York City, all the right, title, and interest for, to, and in the said patent to the said Houghton; that he verily believes that the said Houghton had and did possess the whole right to said patent when he assigned the same to W'm F. Ladd and Morris L. Keen, and that the said Ladd and
302 Keen are now the owners of the entire patent; that he believes the said Houghton is not in the United States, but that he resides in Europe, and that he has no knowledge of where the deed of conveyance, which he made for himself and as attorney of Charles Watt, is, but is informed that it is lost or mislaid.

(Signed) HUGH BURGESS.

Sworn to and subscribed before me this thirteenth day of September.
(Signed) JOHN MUNCHOWER.

Filed 17th September, 1858.

EXHIBIT R.—K. G. W., *Ex.*

Whereas Charles Watt and Hugh Burgess, of London, England, did obtain letters-patent of the United States for certain improvements in the manufacture of paper from wood, which letters-patent bear date the eighteenth day of July, 1854; and whereas the said Charles Watt and Hugh Burgess, by indenture made November 22d, 1854, duly assigned and transferred said letters-patent and all and singular their right, title, and interest therein, incident thereto or growing thereout, unto Frederick B. Houghton, of the city of New York, and the parties of the second part hereto are entitled to an assignment thereof, under and by virtue of an agreement between the parties hereto, dated January 27, 1855:

Now, therefore, this indenture, made this twentieth day of March, 1855, between Frederick B. Houghton, of the city of New York, of the first part, and William F. Ladd, of the same place, and Morris L. Keen, of the city of Philadelphia, of the second part, witnesseth that the said party of the first part, for and in consideration of the premises and of one dollar to him in hand paid by the parties of the second part hereto, the receipt whereof is hereby acknowledged, hath granted, bargained, sold, assigned, transferred, and set over unto them, the said parties of the second part hereto, all and singular the before-mentioned let-
303 ters-patent, and all matters and things incident thereto or growing thereout: To have and to hold the said letters-patent unto

them, the said parties of the second part, and their respective heirs and assigns, for and during the period, and subject only to the conditions and provisions, contained in the aforesaid agreement.

Witness my hand and seal this twentieth day of March, one thousand eight hundred and fifty-five.

F. B. HOUGHTON. [L. S.]

Sealed and delivered in presence of—
GEO. P. NELSON.

CITY AND COUNTY OF NEW YORK, *ss:*

On this twentieth day of March, 1855, before me came Frederick B. Houghton, to me personally known to be the same person described in and who executed the above written instrument, and acknowledged to me that he executed the same.

GEO. P. NELSON,
Commissioner of Deeds.

STATE OF NEW YORK,
City and County of New York, ss:

I, Richard B. Connolly, clerk of the city and county of New York, do hereby certify that George P. Nelson, whose name is subscribed to the certificate of the proof or acknowledgment of the annexed instrument, and thereon written, was, at the time of taking such proof or acknowledgment, a commissioner of deeds for said city and county, dwelling in the said city, commissioned and sworn, and duly authorized to take the same. And further, that I am well acquainted with the handwriting of such commissioner, and verily believe that the signature to the said certificate of proof or acknowledgment is genuine.

In testimony whereof I have hereunto set my hand and affixed the seal of the county, the 3d day of April, 1855.

[SEAL.] RICHARD. B. CONNOLLY, *Clerk.*

304 A. H. S., No. 6.

The wood, upon which it is intended to operate by this process, should first be reduced to very fine shavings; the finer the better. This may be done by any suitable machine. The shavings should then be boiled in caustic alkali of the strength indicated by about 12 of the English hydrometer. This process is much better performed under pressure. After the wood has been boiled for about 24 hours, (but we do not confine ourselves to this time as it varies with the nature of the wood & amount of pressure, &c.,) it should be well washed & squeezed to remove all the alkali. It is then placed in a chamber furnished with racks, about 9 inches apart, upon which the wood is placed & exposed to the action of chlorine or any of the compounds of chlorine with oxygen, however obtained. The wood should be exposed to the action of chlorine or its compounds with oxygen, until it assumes an orange color & falls into a pulpy mass on the addition of caustic alkali. The following plan we find to be a convenient & economical means of obtaining chlorine. A certain quantity of chloride of calcium (muriate of lime) is to be mixed with the quantity of chromic necessary for the mutual decomposition of chlor. calcium & chromic acid, which *callic* acid may be prepared from rough c'romate of potash or soda or the chrome residue from the bleaching of palm-oil or tallow with chromic acid. This mixture is then heated in a suitable retort when a large quantity of chlorine is given off. The mass is to be heated to dryness which is best done in clay gas-retorts, till no more

chlorine is given off. The mass, which is now composed of chromite
305 of lime & chloride of chromium should be powdered & placed on an iron-plate exposed to a cherry-red heat, or this may be done in a retort, taking care that there is a supply of atmospheric air brought to play upon or through the powder. This heat must be continued till the powder turns of a yellowish brown colour, when it may be removed and placed in a tank containing a sufficient quantity of H. cl. to combine with the lime. The mixture may be gently heated when chloride of calcium is formed & free chromic acid. This may be again placed in the chlorine retort & heated, when a further supply of chlorine is obtained. This process may be repeated till most of the chromic acid is converted into chloride of chromium. When this takes place which it may do after three treatings with H. cl., and as above-described, the mats, containing the chloride of chromium, should be dissolved in water mixed with the necessary quantity of milk of lime, until a precipitate is free, which should be dried, heated to a cherry-red, when the chlorine will be given off. The resulting mixture may be again treated as above-described.

When the wood has been sufficiently acted upon by the chlorine or its compounds with oxygen, it is to be removed from the gasing-cham-
306 ber, and the H. cl. with which it is saturated, which is formed by the action of the chlorine, is to be removed with water, & the wood pressed so as to remove as much of the water & acid as possible, and which may be used to decompose the chromate of lime in the process before-described. After all the acid has been removed from the wood, it is to be placed in a suitable vessel, & a weak solution of caustic alkali poured upon it so as to cover it, when the wood falls into a pulpy mass & of a dark brown or almost black colour. This part of the process may be expedited by having a beater or engine working in the tank or vessel in which the alkali is placed.

The alkali in this & the former process should be all saved & evaporated down by any waste heat from the boiler or retort furnaces & reburnt, when it may again be used for the same purposes. The pulp, after being well washed, has now to be bleached. This may be done in the usual way, or we prefer to add a certain quantity of chlorite of soda called also hypochlorite & liberating the hypochlorous acid—H. cl. The quantity of chlorite of soda to be used can only be learned by experience.

307 (Indorsed:) Outlines of pulp patent. Paper No. 1. Exhibit produced by Mr. Burgess in answer to interrogatory 6th. C. S., U. S. comm'r.

308 EXHIBIT S.—K. G. W., *Examiner*.

Whereas Charles Watt and Hugh Burgess, of London, England, did obtain letters-patent of the United States for certain improvements in the manufacture of paper from wood, which letters-patent bear date the eighteenth day of July, 1854;

And whereas the said Charles Watt and Hugh Burgess, by indenture, made November 22nd, 1854, duly assigned and transferred said letters-patent, and all and singular their right, title, and interest therein, incident thereto, or growing thereout, unto Frederick B. Houghton, of the city of New York, and the parties of the second part hereto are entitled to an assignment thereof, under and by virtue of an agreement between the parties hereto, dated January 27th, 1855:

Now, therefore, this indenture, made this twentieth day of March,

1855, between Frederick B. Houghton, of the city of New York, of the first part, and William F. Ladd, of the same place, and Morris L. Keen, of the city of Philadelphia, of the second part, witnesseth:

That the said party of the first part, for and in consideration of the premises and of one dollar to him in hand paid by the parties of the second part hereto, the receipt whereof is hereby acknowledged,
309 hath granted, bargained, sold, assigned, transferred, and set over unto them, the said parties of the second part, all and singular the before-mentioned letters-patent, and all matters and things incident thereto or growing thereout:

To have and to hold the said letters-patent unto them, the said parties of the second part and their respective heirs and assigns, for and during the period, and subject only to the conditions and provisions contained in the aforesaid agreement.

Witness my hand and seal this twentieth day of March, one thousand eight hundred and fifty-five.

F. B. HOUGHTON. [L. S.]

Sealed and delivered in presence of—
GEO. P. NELSON.

CITY & COUNTY OF NEW YORK, *ss:*

On this twentieth day of March, 1855, before me, came Frederick B. Houghton to me personally known to be the same person described in and who executed the above-written instrument, and acknowledged to me that he executed the same.

GEO. P. NELSON, *Comm'r of Deeds.*

310 STATE OF NEW YORK,
City and County of New York, ss:

I, Richard B. Connolly, clerk of the city and county of New York, do hereby certify that Geo. P. Nelson, whose name is subscribed to the certificate of the proof or acknowledgment of the annexed instrument and thereon written, was, at the time of taking such proof or acknowledgment, a commissioner of deeds for said city and county, dwelling in the said city, commissioned and sworn, and duly authorized to take the same. And further that I am well acquainted with the handwriting of such commissioner, and verily believe that the signature to the said certificate of proof or acknowledgment is genuine.

In testimony whereof I have hereunto set my hand and affixed the seal of the county the 3rd day of April, 1855.

[OFFICE SEAL.] RICH'D B. CONNOLLY, *Clerk.*

UNITED STATES PATENT-OFFICE.

Rec'd 4th & recorded 9th April, 1855, in liber O 3, page 381,
311 of transfers of patent-rights.

In testimony whereof I have caused the seal of the Patent-Office to be hereunto affixed.

[SEAL OF PATENT-OFFICE.] S. T. STINGAT,
Act'g Com'r of Patents.

Ex'd. C. E. U.

(Indorsed:) Frederick B. Houghton to William F. Ladd & Morris L. Keen. Assignment of letters-patent. Filed May 21st, 1867. R. 4 April, 1855. Fee $2 paid.

312 EXHIBIT S.—K. G. W., *Examiner.*

Whereas Charles Watt and Hugh Burgess, of London, England, did obtain letters-patent of the United States for certain improvements in the manufacture of paper from wood, which letters-patent bear date the eighteenth day of July, 1854;

And whereas the said Charles Watt and Hugh Burgess, by indenture, made November 22nd, 1854, duly assigned and transferred said letters-patent, and all and singular their right, title, and interest therein, incident thereto, or growing thereout unto Frederick B. Houghton, of the city of New York, and the parties of the second part hereto are entitled to an assignment thereof under and by virtue of an agreement between the parties hereto, dated January 27th, 1855:

Now, therefore, this indenture, made this twentieth day of March, 1855, between Frederick B Houghton, of the city of New York, of the first part, and William F. Ladd, of the same place, and Morris L. Keen, of the city of Philadelphia, of the second part, witnesseth:

That the said party of the first part for and in consideration of the premises and of one dollar to him in hand paid by the parties of the second part hereto, the receipt whereof is hereby acknowledged,

313 hath granted, bargained, sold, assigned, transferred, and set over unto them, the said parties of the second part hereto, all and singular the before-mentioned letters-patent and all matters and things incident thereto or growing thereout:

To have and to hold the said letters-patent unto them, the said parties of the second part and their respective heirs and assigns, for and during the period, and subject only to the conditions and provisions contained in the aforesaid agreement.

Witness my hand and seal this twentieth day of March, one thousand eight hundred and fifty-five.

F. B. HOUGHTON. [L. S.]

Sealed and delivered in presence of—
GEO. P. NELSON.

CITY & COUNTY OF NEW YORK, *ss:*

On this twentieth day of March, 1855, before me, came Frederick B. Houghton, to me personally known to be the same person described in and who executed the above-written instrument, and acknowledged to me that he executed the same.

GEO. P. NELSON,
Comm'r of Deeds.

314 STATE OF NEW YORK,
City and County of New York, ss:

I, Richard B. Connolly, clerk of the city and county of New York, do hereby certify that Geo. P. Nelson, whose name is subscribed to the certificate of the proof or acknowledgment of the annexed instrument and thereon written, was, at the time of taking such proef or acknowledgment, a commissioner of deeds for said city and county, dwelling in the said city, commissioned and sworn, and duly authorized to take the same. And, further, that I am well acquainted with the handwriting of such commissioner, and verily believe that the signature to the said certificate of proof or acknowledgment is genuine.

In testimony whereof I have hereunto set my hand and affixed the seal of the county the 3rd day of April, 1855.

[OFFICIAL SEAL.] RICH'D B. CONNOLLY, *Clerk.*

UNITED STATES PATENT-OFFICE.

Rec'd 4th & recorded 9th April, 1855, in liber O 3, page 281,
315 of transfers of patent-rights.

In testimony whereof I have caused the seal of the Patent-Office to be hereunto affixed.

[SEAL OF PATENT-OFFICE.] S. T. STINGAT,
Act'g Com'r of Patents.

Ex'd. C. E. U.

(Indorsed:) Frederick B. Houghton to William F. Ladd & Morris L. Keen. Assignment of letters-patent. Filed May 21st, 1867. R. 4 April, 1855. Fee $2, paid.

316 In the circuit court of the United States for the eastern district of New York.

THE AMERICAN WOOD-PAPER CO.
vs.
THE FIBRE-DISINTEGRATING CO. } In equity.

Testimony taken on the part of the defendants, under the 67th rule of the Supreme Court of the United States, for final hearing, by R. E. Stilwell, examiner in equity.

THURSDAY, *June 6th*, 1867.

Present, George Gifford, esquire, counsel for defendants; Francis C. Nye, esquire, counsel for complainants.

THOMAS HOWLAND, called, and sworn as a witness on the part of the defendants, deposes and says:

Q. 1. You have already been examined in this case, have you?

A. Yes.

Q. 2. State whether or not any pulp, made from straw, was, at any time, received at the defendants' mill at Stockport, New York, from the mill at Brooklyn, to be made into paper at Stockport.

A. Yes; there was.

Q. 3. State whether all of the straw-pulp made at the mill in Brooklyn was sent to Stockport.

A. Yes; it was.

Q. 4. What was done with the straw-pulp sent from the mill in Brooklyn to Stockport?

317 A. It was made into brown paper.

Q. 5. Was any of it bleached?

A. No; it was not. It was made into brown paper.

Q. 6. Have the defendants, so far as you know, made and sold any bleached paper made from straw, or from straw mixed with any other material.

A. No; not that I know of.

Q. 7. Do you know of the defendants using a small boiler for experiments in pulping fibrous materials?

A. Yes.

Q. 8. Do you know of the defendants trying experiments with that boiler in the manufacture of white paper, made from straw, which had been steam-blown?

A. I do.

Q. 9. Have you seen any sample or samples of white paper produced by such experiments?

A. I have.

Q. 10. In your evidence heretofore given in this case you spoke of the use by your firm, Beach & Howland, of a Spofford rotary-boiler, made for said Beach & Howland, of Fort Edward, Washington Co., and put up in the fall of 1852, and that you boiled in that boiler rags, Kentucky rope, and Kentucky bagging. Please state what liquid you boiled those materials in; also state what was the product, and where it was made.

(Objection by complainants.)

A. We charged the boiler with soda-ash and lime. The quantity was governed by the quantity of the rags we put in. With very dark rags we increased the quantity of soda-ash and lime. The same as to Kentucky hemp and ropes, and which we produced white paper from all three of those materials bleached together. It was made at Fort Edward, N. Y., at Beach & Howland's mill.

Q. 11. Was the liquid in which you boiled the materials you have mentioned called caustic alkali?

(Objection by complainants.)

A. It was.

318 Q. 12. During the period from the fall of 1852 until the first of May, 1853, about how much white paper was made in the manner and of the materials you have mentioned?

(Objection by complainants.)

A. About a ton and a half, upon an average, per day.

Q. 13. Who had that mill at Fort Edward after the first of May, 1853?

A. Manning, Peckham & Howland.

Q. 14. What Howland was that?

A. Gardiner Howland, of Sandy Hill, just above Fort Edward; three miles above.

Cross-examined:

Q. 15. When did you begin to act as superintendent of the defendants' works at Stockport?

A. I believe it was in the fall of 1855.

Q. 16. Do you mean that you began to act there at that time for the Fibre-Disintegrating Co.?

A. Yes; I do.

Q. 17. When and in what capacity were you first employed by the Fibre-Disintegrating Co?

A. On the first of January, 1864, as general superintendent of the paper department.

Q. 18. Where did you begin, on the first of January, 1864, to act as general superintendent of the defendants' paper department?

A. At Elizabethport, N. J.

Q. 19. And you afterwards became general superintendent of their mill at Stockport, did you not? If so, when?

A. I did; in the fall of 1865. I made an error in answering the 15th cross-interrogatory.

Q. 20. When did you begin to act as selling-agent of the defendants' paper?

A. In the spring of 1866.

Q. 21. Where were you occupied as selling-agent of the defendants?

A. Here in New York.

319 Q. 22. Have you ever been in the employment of the defendants

anywhere else except at Elizabethport, Stockport, and New York? If so, where?

A. Nowhere else.

Q. 23. Have you ever visited their works at Red Hook? If so, when and how often?

A. I did; when they commenced there. Sometimes every day, and sometimes once in two weeks.

Q. 24. When did you last visit their works?

A. About the first of July last.

Q. 25. Did you visit their works at Red Hook, South Brooklyn, while you acted as superintendent of their mill at Stockport?

A. Yes; whenever I came to the city.

Q. 26. What was the purpose of your visits?

A. To see what improvements they had been making while I was absent.

Q. 27. Was that all you visited their works for?

A. At the time I was at Stockport, it was.

Q. 28. What did you go there for when you were their selling-agent in New York?

A. To see what improvements they had been making.

Q. 29. What else did you go there for at that time?

A. Nothing else.

Q. 30. Then you never visited the defendants' works in South Brooklyn for any purpose except to see what improvements they had been making, did you?

A. No; except to give them my opinion about arranging the machinery. It was nothing but the paper department—the making of paper—that I had anything to do with.

Q. 31. Then the improvements that you went there to see were always connected with the manufacture of the paper from the pulp, were they?

A. They were, sir.

Q. 32. And you paid no attention to the previous part of the producing the pulp, did you?

A. No; I did not pay any attention to it?

Q. 33. Were the defendants manufacturing paper from their pulp when you made those visits?

A. No; not when I made visits there—while I was superintendent at Stockport.

320 Q. 34. How was it, when you made those visits while you were their selling-agent?

A. The same; they had no machinery to make paper there.

Q. 35. Yet you went over there to see what improvements they had made in their paper-making machinery, when you knew they had no paper-making machinery there, did you?

A. I went there to see what improvements they were making in pulp.

Q. 36. What improvements did you discover?

A. I cannot say.

Q. 37. Do you remember any one improvement that you discovered they had made in the manufacture of pulp in all your visits when they had no paper-making machinery? If so, name it.

A. I do not know of any.

Q. 38. Do you know anything of the manufacture of pulp at the defendants' works in South Brooklyn, except what you have heard from others? If so, what?

A. No; nothing more.

Q. 39. Do you know anything of the quantity or quality of the pulp

manufactured by the defendants at South Brooklyn except what you have heard from others? If so, what?

A. No; I do not.

Q. 40. Do you know anything of what was done by the defendants' agents at South Brooklyn with the pulp manufactured there, except what you have heard from others; if so, what?

A. It was all sent to Stockport to be made into paper there.

Q. 41. Do you know that of your own knowledge? If so, when did you learn it, and how?

A. Whenever I was in the city it was all sent up to Stockport, to be made into paper.

Q. 42. Do you know what was done by the defendants' agents at South Brooklyn with the pulp manufactured there, of your own knowledge, when you were not in the city? If so, when did you learn that, and how?

321 A. All that I know about it is, that they said all the pulp that was manufactured there was sent up to Stockport to be manufactured into paper.

Q. 43. Did you learn what you have stated they did when you were in the city with their pulp, in the same way, or not? If not, how?

A. In the same way.

Q. 44. Then you swear from what they told you, do you, when you say that all the pulp made from straw and otherwise at South Brooklyn, was sent up to Stockport to be made into paper?

A. I do.

Q. 45. Can you swear, of your own knowledge, that the defendants never manufactured any paper from their straw-pulp or bamboo-pulp at South Brooklyn?

A. They did manufacture some paper from bamboo at South Brooklyn.

Q. 46. Then their agents at South Brooklyn told you that they sent all their pulp up to Stockport to be manufactured into paper, while at the same time you know, of your own knowledge, that they kept some of it at South Brooklyn, and made it into paper there, did they?

(Objected, that the question assumes what the witness has not stated, that is, that they kept pulp at Red Hook to be made into paper there, after the mill at Stockport had been set running.)

A. Not after the mill at Stockport was started, because the machinery was all taken away.

Q. 47. How do you know that the defendants made bamboo paper at South Brooklyn, before the paper-making machinery set up there was removed to Stockport?

A. Because I had made it myself.

Q. 48. Then you have been in the employment of the defendants at South Brooklyn? If so, when, in what capacity, and for how long?

A. I was, in the capacity of taking charge of the paper-machinery and making paper? I cannot say exactly when it was, nor how long it was, when I was there making paper.

Q. 49. In what year was it, and in what part of the year?

322 A. In 1866; somewhere in the summer, if I remember right.

Q. 50. Who was the superintendent of the defendants' works at Brooklyn, while you had charge of the paper-making there?

A. McCracken; I forget his Christian name.

Q. 51. How much paper was made there under your charge, and of what material?

A. I cannot say the amount; the material was bamboo.

Q. 52. Was any other material used beside bamboo, while you had charge of the paper-making there?

A. No, sir; no other.

Q. 53. Can you swear, from your own knowledge, that no paper was made at South Brooklyn by the defendants from straw-pulp, while you were not engaged there?

A. I have no reason to believe there was any straw-paper made there.

Q. 54. Do you know, of your knowledge, whether the defendants have made any paper from straw-pulp at their works at South Brooklyn, while you were not engaged there?

A. I am not aware of any straw-paper being made there; not that I know of. I do not think it could have been made there without my knowledge, because I was there every day when the machinery was running? It did not run without I was there.

Q. 55. Do you know, of your own knowledge, or have you learned from others that no straw-pulp was made at the defendants' mills at South Brooklyn, while you were not engaged there?

A. I never knew any straw-pulp was made there, either of my own knowledge or from others.

Q. 56. Then, if any straw-pulp made there at that time by the defendants was sent up to Stockport, you do not know it, do you?

(Objected to, that the time referred to is not stated, whether it was whilst the witness was engaged at the mill at South Brooklyn or some other time.)

A. I am not aware of any.

Q. 57. Have you been previously examined as a witness in a
323 cause in the northern district of New York, in the circuit court of the United States, wherein Coe S. Buchanan was complainant and Gardner Howland and Joseph B. Palser were defendants?

A. I was.

Q. 58 That was before the year 1863, was it not?

A. It was.

Q. 59. When you manufactured paper at Fort Edward, in 1852, and afterwards as one of the firm of Beach & Howland, state whether you had a safety-valve on the rotary boiler in which you boiled the material for the manufacture of paper?

A. I did not.

Q. 60. State whether you had a steam-*guage* on that rotary boiler.

A. There was no steam-*guage* on the rotary boiler.

Q. 61. State how that rotary boiler was supplied with steam.

A. From a pipe from the steam-boiler leading to the rotary boiler, in the gudgeon of the rotary boiler?

Q. 62. How far was the steam-boiler from the rotary boiler?

A. I should think about two feet? There was just a brick wall betwixt them.

Q. 63. State whether that steam-boiler had a steam-*guage*.

A. Yes.

Q. 64. What kind of a steam-*guage*?

A. It was one of the round clock kind; a spring-gauge.

Q. 65. Had it also a safety-valve?

A. Yes, sir.

Q. 66. At how many pounds was the safety-valve on that steam-boiler set to blow off?

A. Sixty.

Q. 67. State how much pressure you considered sufficient at that time

to be kept up in the rotary boiler for the purpose of bleaching the material under operation.

(Objected to.)

A. From 50 to 60 pounds (to bleach,) and from twelve to fifteen hours; that was our general rule for doing it.

324 Q. 68. State, if you know, whether the pressure in that rotary boiler was less than 60 pounds? If so, how much less?

A. I do not know, because I had no safety-valve on the rotary boiler, but I should think it might be one or two pounds less, but do not know.

Q. 69. State whether about 50 pounds pressure in the rotary boiler was or was not all that was necessary, so far as you knew at that time, for bleaching the straw or anything else you had under operation at that time?

A. We considered 60 pounds better than 50, at that time.

Q. 70. State whether you have since learned that a higher pressure than 50 or 60 pounds is more advantageous for bleaching the material under operation.

A. I have, and especially on straw.

Q. 71. State whether, during the boiling in that rotary boiler, you did anything to ascertain when the contents were at the boiling point, or when the pressure was nearest up to the pressure in the steam-boiler?

A. We ascertained that when the steam got up high enough to blow off at 60 pounds pressure on the steam-boiler. We did nothing else.

Q. 72. State whether the steam from the steam-boiler was used for any other purpose but to supply the rotary-boiler.

A. Yes, for the paper machine. This was at the same time that we were supplying the rotary boiler. There was but one steam-boiler there.

Q. 73. State whether your firm made any paper at Fort Edward, before you sold out to Manning, Peckham & Howland, from nothing but rope made from Kentucky hemp rope.

A. We did not.

Q. 74. What proportion of such rope did you use with your rags?

A. About twenty-five per cent.

Q. 75. Did you ever use a less quantity?

A. I do not think I did.

Q. 76. State whether you tested, by a hydrometer or otherwise, the strength of the alkaline solution that you used at Fort Edward?

325 A. We did not.

Q. 77. Do you know, of your own knowledge, of the defendants using an experimental boiler at South Brooklyn while you were not engaged there?

A. No; I do not.

Q. 78. Have the defendants manufactured any white paper, at Stockport, from pulp made by them at South Brooklyn and sent there?

A. They have.

Direct resumed by Mr. Russell:

Q. 79. Did you act as superintendant of the defendants' mill, at Stockport, from the commencement of their operations at that mill in making paper from the pulp sent up from Brooklyn?

A. I did.

Q. 80. Did you, from time to time, see the pulp at South Brooklyn which was prepared to be sent from the mill at Stockport?

A. I did.

Q. 81. Did you have anything to do with the transportation of that pulp from Brooklyn in the way of suggesting how it should be packed and sent?

A. I did.

Q. 82. Do you recollect an improvement being introduced into the defendants' works at Brooklyn by the introduction of beating-engines to beat up and wash the steam-blown bamboo before it was put into the pulping boilers?

(Objection by complainant.)

A. I do not.

Q. 83. Was that improvement introduced within a year before the first of July last?

(Objection to form.)

A. They were introduced a year before the first of July last.

Q. 84. Were you consulted by the president of the defendants, The Fibre-Disintegrating Company, about the putting up of those beating-engines; and did you watch the erection of them, and their operation?

326 A. I was so consulted, and did watch the erection of them, and the operation of them after they were put up.

THOMAS HOWLAND.

Subscribed and sworn to before me, this sixth day of June, 1867.

R. E. STILWELL,
Examiner, &c.

FRIDAY, *June 7th*, 1867.

Present, counsel for the respective parties.

Defendants' counsel puts in evidence certified copy of letters-patent, issued by the United States to Lemuel W. Wright, dated the 27th of March, 1847, and which is marked Defendants' Exhibit No. 24.

Also, letters-patent issued by the United States to Azel Storrs Lyman, dated the 4th of August, 1858, and which is marked Defendants' Exhibit No. 25.

Also, a certified copy of an extract from a German publication, which is marked Exhibit No. 26.

Also, a certified copy of an extract from another German publication, which is marked Exhibit No. 27.

EMIL VOSSNACK, being called and sworn on the part of defendants, deposes and says:

Q. 1. What is your name, age, and occupation, and where do you reside?

A. Emil Vossnack; aged 26 years; am a mechanical engineer, and reside in New York City.

Q. 2. Do you understand the German and French languages, and is one branch of your business the translating of German and French into English?

A. I do understand those languages, and it is one branch of my business to translate them into English.

327 Q. 3. Look at the paper now shown you, and marked Exhibit No. 28, and state what it is a copy of, and what it was copied from?

A. It is a copy of a French patent, No. 2666, granted to Mr. Gros, of Batignolles, for the employment of broom-plant in the manufacture of paper, dated March 20, 1847. It is a copy Brevet d'Invention, second series, volume 10, pages 94, 95, and 96, printed in the year 1852.

Q. 4. Look at the paper now shown you, and marked Exhibit No. 29, and state whether it is a translation of Exhibit No. 28.

A. It is, and I translated it myself.

Q. 5. Look at the paper now shown you, and marked Exhibit No. 30, and state what it is a copy of, and what it was copied from?

A. It is a copy of a French patent granted to Messrs. Montgolfier Freres, at Paris, February 7th, 1838, for the manufacture of paper from wood. Also for pasteboard or bituminized wood. It is copied from Brevet d'Invention, first series, volume 67, page 15 to 16, plate 2.

Q. 6. Look at the paper now shown to you and marked Exhibit No. 31, and state whether it is a translation of Exhibit No. 30?

A. It is. I translated it partly myself, and looked over the part which I did not translate, and the whole of it is a correct translation.

Q. 7. Look at the paper now shown to you, marked Exhibit No. 32, and state what it is a copy of, and what it is copied from?

A. It is a copy of a French patent, No. 4566, granted to Mr. Charles Wise, of Paris, for an improved apparatus for treating with lye, and bleaching rags and other materials used in making paper, which apparatus can also be adapted to other uses, dated May 12, 1838, and taken from Brevet d'Invention, first series, vol. 43, pp. 37, 38, 39, and 40, and plate No. 3.

Q. 8. Look at the paper now shown you and marked Exhibit No. 33, and state whether it is a translation of Exhibit No. 32?

A. It is. I translated it partly myself; looked over the part I did not translate, and found it correct.

328 Q. 9. Look at the papers now shown you and marked Exhibits Nos. 34 and 35, and state what they are translated from, respectively.

A. Exhibit 34 is a translation from an extract of Exhibit 26; Exhibit 35 is a translation of an extract of Exhibit 27.

EMIL VOSSNACK.

Subscribed and sworn to before me, this 7th day of June, 1867.

R. E. STILWELL,
Examiner, &c.

HENRY B. RENWICK, called and sworn as a witness on the part of defendants, deposes and says:

Q. 1. What is your name, age, residence and profession?

A. Henry B. Renwick; forty-nine years of age; residence, New York City, and am a civil and mechanical engineer.

Q. 2. Have you read the copies of letters-patent granted to Morris L. Keen, for alleged improvements in boilers, which are annexed to the bill of complaint in this case and numbered, respectively, 25418, and 38901, and do you understand the contents of them?

A. I have read the copies and understand their contents.

Q. 3. What do you understand to be described and specified as the invention of said Keen in said patent No. 25418?

A. I have some doubt as to which of the combinations is there specified as Keen's invention, but am convinced that either one or the other of them is a combination described and specified as his invention. One of these combinations is that of a boiler, of any form, suitable for making pulp, with an expansion-chamber, and any kind of stirrers that will act to mix it up, and stir the pulp, and with a discharge valve or cock so constructed that the contents of the boiler can be blown off through it. The other combination is that of a boiler provided with an expansive chamber (the boiler being suitable for the boiling of wood under pressure), with stirrers, constructed and arranged substantially as de-

329 scribed in the patent, and with a blow-off cock, as before stated; the substantial construction and arrangement of the stirrers being that they are oscillating rods with vanes or arms projecting from one side only of the shaft, and the shafts being arranged in such manner that when the vanes are turned toward the periphery of the boiler, the boiler may be charged through the man-hole without the stock falling upon the vanes or stirring arms. The better opinion is that the latter of these two combinations is the one described and specified as of Keen's invention, in patent No. 25418.

Q. 4. What do you understand to be described and specified as the invention of said Keen, in said patent, No. 38901?

A. He first describes and specifies the combination of a boiler suitable for making pulp, with a diaphragm and well; the diaphragm being perforated and extending across the boiler, near the upper part thereof, and the well being a tube of perforated or reticulated material, extending from the diaphragm to the top of the boiler; there being a man-hole plate at the upper end of the well, through which the material is charged into the boiler. The object of the combination being to charge the material through the hole or aperture of the well into that part of the boiler below the diaphragm in such manner that material introduced through the man-hole above the level of the diaphragm shall not fall upon or clog up the diaphragm. He also describes and specifies the combination of the boiler with a discharge pipe and valve for the purpose of blowing out the contents, arranged at or near the lower part thereof. My opinion is that "the boiler," in this combination, means the boiler provided with a diaphragm and well, and not the boiler proper for pulping, such for instance as is described in Keen's patent, 25418, of the year 1850, in which patent is described a boiler with a blow-off-cock at the bottom, and provided with a diaphragm, but without the well and its connections described in patent 38901.

Q. 5. Do you understand the construction of the boiler used by the defendants and which is alleged by the complainants to be an infringement of said Keen's patents. If yea, state from what sources you have derived information of it?

330 (Objected to.)

A. I think I do understand this combination, having read the testimony hitherto taken in this case on that point, and having been furnished by Mr. R. W. Russell with a drawing, which I now produce, and which is numbered Ex. 36, and which he told me was a correct drawing of the vertical boiler used at the Fibre-Disintegrating Company-works of South Brooklyn. I have read from the printed record the depositions of James McCracken, Hugh Burgess, and John P. Townsend.

Q. 6. State whether or not the defendants' boiler, including the stirrers in it, is substantially the same, or substantially different from the boiler described and specified in either of said Keen's patents, and whether there is anything in defendants' boiler which is described and specified in either of said patents as the invention of said Keen, and give your reasons for any conclusions you may express?

A. The defendants' boiler has what *it* may be termed an expansive-chamber, a stirrer, and a blow-off cock, and if Keen's invention, as described and specified in patent 25418, be the combination first enumerated by me in answer to question 3, then the defendants' boiler contains substantially the combination described and specified, 25418; but if Keen's invention be the combination enumerated second by me in that same answer, namely the combination of a boiler suitable for making pulp, with a dis-

charge-valve and with stirrers so arranged and constructed that the contents being charged will not fall upon them, substantially as described in the patent, then the defendants' boiler does not contain the invention of Keen, described and specified in 25418, for the reasons that the defendants' has a rotary stirrer, with arms or vanes projecting from four sides thereof, and so arranged in the boiler that, when the contents are charged, they are directly in the way of the material as it is thrown into the boiler and the construction and arrangement is such that they cannot be moved out of the way of the entering material. The defendants' boiler has no perforated well in it, leading through the perforated diaphragm, nor any way of charging the boiler above the diaphragm.

331 The man-hole in defendants' boiler it substantially below the diaphragm, and there is no necessity for a well. The defendants' boiler, therefore, does not contain either of the combinations described and specified as of Keen's invention, in patent No. 38901, unless the combination last described and specified in that patent, is a combination of any boiler suitable for pulping with a blow-off cock.

Q. 7. Have you examined, and are you familiar with the contents of the patent granted to Charles Wise by the government of France, May 12, 1838, as described in the Brevet d'Invention, 1st series, vol. 43, pages 37, 38, 39, and 40, and the plates therein referred to. If yea, state what is therein described, and compare the leading features of it with the boiler described in said Keen patent, No. 25418, and explain the bearings or effect of the boiler in apparatus described in said Wise patent upon said Keen patent?

A. I have examined and am familiar with the patent published as stated in the question, having read it at the Astor Library, in this city. This patent to Wise describes, first, a rotary boiler, (in that respect like Spofford's) provided with expansive chambers, a blow-off cock, and a grating inside of the boiler which serves to agitate the contents when the boiler is revolved. This boiler has proper man-holes for introducing the material, and pipes for the introduction of steam, and is suitable for the treatment of rags and other matter suitable for the manufacture of paper. In the patent it is stated that the boiler may be made stationary, and the stirrers caused to revolve within it. It is also stated that the boiler may be revolved on its transverse axis, (in which case its axis of revolutions would be vertical,) and that in that case the grating must undergo the necessary modifications (rendered necessary by the change of axis.) There are other modifications of boilers and other forms of stirrers described in the patent. I therefore find described in this patent a boiler suitable for treating rags, etc., provided with expansive chambers, a stirrer to agitate the material being treated, and a blow-off cock, but I do not find described in it stirrers constructed and arranged as described in Keen's patent, 25418, in such manner that the material being charged or thrown into the boiler shall not fall upon the stirrers.

332 I therefore do not find in the patent of Wise the combination specified as of Keen's invention, in patent 25418, unless one element of that combination be any stirrers that will stir the material and not stirrers constructed and arranged as in the patent.

Q. 8. Have you examined, and do you understand the contents of letters-patent of the United States, granted to Lemuel W. Wright, March 27th, 1847; and, if yea, compare the boilers therein described and the leading features of the patent No. 38901, granted to Morris L. Keen, and state the bearing or effect of the boiler or apparatus described in said patent to Wright upon said Keen patents or either of them.

A. I have examined and understand the contents of the patent re-

ferred to in the question, and the boilers B and F, described therein; and I find by reference to the patent (including the drawing) of the form usually employed for high-pressure boilers, namely, cylindrical shells with dome-shaped ends; they are set vertical, are provided with expansive chambers, safety-valve, man-hole plates, apparatus for the admission of steam to heat the contents, and a blow-off or discharge-pipe and valve for the purpose of discharging the contents of the boiler, under pressure, and in the respect that those boilers are vertical, have expansive chambers, and blow-off cock, they are in all respects substantially identical with the boilers described in Keen's patents, Nos. 25418 and 38901. If the combination last described and specified in patent No. 38901, be the combination of any boiler proper for pulping, with a discharge-pipe and valve properly arranged with reference thereto, for the purpose of cleaning out or discharging the contents of the boiler, under pressure, then I find that combination described in the patent granted to Wright referred to in the question.

HENRY B. RENWICK.

Adjourned to 10½ a. m., the 8th inst.

233 SATURDAY, *June 8th*, 1867.

Present, counsel for the respective parties.

Q. 9. Assuming what is described in said Wise patent, and in said Wright patent, to have been known prior to the time of the alleged invention by said Keen, ot what is described and specified in his invention in his said two patents, then do you find anything described and specified in either of said Keen-patents as his invention, which is in the defendants' boilers, and which is not described in either the patent of said Wise or the patent of said Wright?

A. Under the assumption in the question, I do not.

Q. 10. How, in any way, does the boiler described in the Keen patent No. 25418, dated September 13, 1859, bear upon or affect the construction of the Keen patent No. 38901, dated June 6, 1863?

A. In the Keen patent 25418, of 1859, there is described a vertical cylindrical boiler with a funnel-shaped bottom, to the lower part of which is attached a discharge proper, closed by a valve or stop-cock, for the purpose of blowing out the material that has been treated. In his patent No. 38901, the same things, having the same arrangement, on the same mode of operation are described; therefore, if the invention described and specified in the second claim of this patent be the combination of a discharge pipe and valve, arranged as described, with any boiler, or with a vertical cylindrical boiler with a funnel-shaped bottom, where that same combination is described in his prior patent, 25418. On the other hand, if the combination described and specified in the second claim be the combination of the discharging pipe and valve, as before stated, with the boiler described, that is, a boiler provided with a perforated well leading from a large hole in the diaphragm to a man-hole, then this combination is not found described in Keen's prior patent, 25418.

HENRY B. RENWICK.

334 MONDAY, *June* 10, 1867.

Present, counsel for the respective parties.

Cross-examined by Thomas A. Jenckes, esq., counsel for complainants:

Q. 11. What do you understand to be the use of the diaphragm in the Keen boiler and in the defendants' boiler?

A. To prevent the wood or other fibre under treatment from rising up into the expansion-chamber, when the bulk of the whole mass expands in consequence of being heated.

Q. 12. Describe the expansion-chamber in the Keen boilers and in the defendants' upright boiler, and the use of it in each?

A. In one of the Keen boilers the expansion-chamber is of a smaller dimension than the boiler secured on the top of it. In the other it is a space at the top of the boiler not filled with material when the boiler is charged. In the defendants' upright boiler it a space at the top of the boiler not filled with the material when the boiler is charged. In all three of them its use is that of a space not filled with material, into which a portion of the charge expands. If this space were not left unfilled, some of the charge would escape through the safety-valve when heat was applied.

Q. 13. How high do you understand that each of the boilers are to be filled with liquid during the operation of boiling.

A. I find no direction in either of the Keen patents as to the height to which the boilers are to be filled with liquid, and I am not able to state how much the mass will expand during the operation of boiling without knowing the temperature at which it is introduced and that to which it is raised. I would also have to procure a table of expansions to determine the point. In defendants' boiler the materials cannot be charged to fill it higher than the lower part of the man-hole plate-tube, which is some distance below the diaphragm. How much the mass will expand while boiling I do not know, for reasons as before stated. I should fill defendants' as high as I could through the man-hole plate-tube,
335 and Keen's nearly up, or up to, or a little above the diaphragm, if I had found by trial that filling to that extent would leave sufficient room for expansion.

Q. 14. Is it not intended that each boiler should be filled as nearly up to the diaphragms as possible with the wood or other material to be boiled, and to fill each high enough with liquid to be certain that the wood or other material would be submerged during the whole operation of boiling?

A. I should think that the manner of filling, both with wood and liquid, set forth in the question would be the proper one, provided space enough is left in all cases for expansion during the boiling operation, but as before stated, in substance, in Keen's boilers the liquid may be charged above the diaphragm, provided room enough is left for expansion. In all cases it would be advantageous, if possible, (and it would certainly be so in Keen's,) so to charge that the wood would be submerged during the whole boiling.

Q. 15. In the Wise apparatus what do you consider to be the expansion-chamber?

A. When the boiler represented at Fig. 1 of his drawings is made stationary as described, or revolves upon its transverse axis as described, then the three small chambers on top of which the man-hole plates *g g* are bolted, are the expansion-chambers. In the boiler represented at Fig. 4, that part of the boiler which is not charged full of liquid would be the expansion-chamber.

Q. 16. In your last answer do you assume that the boiler, Fig. 1, is to be filled up to the small spaces below the man-hole with the rags or other materials submerged in liquid?

A. I do not exactly understand the question. There is no direction in

the patent as to the quantity of liquid, except that it is to be sufficient to cover the axis on which the strainer revolves, nor as to the quantity of rags or other materials. I assumed that boiler, Fig. 1, when made stationery or revolving on its transverse axis, was to be charged up to the bottom of the spaces, or to a point some distance below the top of the boiler.

Q. 17. How much below the bottom of the man-hole chambers do you understand that the surface of the liquid should be, in giving your last two answers?

336 A. I do not understand that there is any precise direction on the subject. In case of a horizontal stirrer, a surface of liquid a little above the centre of the boiler would be within the directions of the patent; a higher level would also be within the directions. In case of a vertical stirrer, the liquid would, if the directions be followed, fill the boiler to the lower side of the man-hole tubes.

Q. 18. What do you understand to be the stirrer in the Wise's patent?

A. In boiler, Fig. 1, I understand the stirrer to be revolving gratings, extending like blades from an axis revolving either in the longitudinal or the transverse axis of the boiler. In the *the* boiler, Fig. 4, the interior surface of the cage or carcass, and the blades upon it, forms the stirrer when it revolves.

Q. 19. Do you find any direction, in using either apparatus in the Wise patent, that the liquid should cover the whole of the material during the entire operation?

A. By reference to the patent, I do.

Q. 20. Do you find any diaphragm in the Wise patent similar to, or performing the functions of, the diaphragm in the Keen boiler?

A. I do. The cage or carcass, or cylinder, pierced with holes, of Fig. 4, will serve to keep the wood submerged if the liquid be filled up to, or afterwards during treatment expands up to or above, the level of the top of the cage.

Q. 21. In case the direction in the specification, as translated, Exhibit 33, is followed, and a sufficient quantity of lye or alkaline liquid is poured into the cylinder to cover the hollow axis *b b*, what function of the diaphragm is performed by the carcass or cage in the Wise boiler?

A. The directions quoted are in reference to the apparatus, Fig. 1, and not to that in which the cage is employed, and they consequently have no bearing upon the function of the carcass of Fig. 4.

Q. 22. Do you understand the phrase in the description of the functions of the apparatus represented in Figure 4, in which it is said, in Exhibit 33, "that the proper quantity of lye is turned into the boiler by the opening OO," gives instruction for turning into that apparatus a different quantity of lye from that directed into apparatus, Fig. 1?

337 A. By reference to the original I find that the exact translation of the words of the original are, a "suitable quantity of lye" is to be turned, etc., but I do not think that the phrase, either in the original or as quoted in the question, give directions for turning into Fig. 4 a different quantity of lye from that directed to be turned into Fig. 1. The directions as to quantity are indefinite as regards either apparatus.

Q. 23. Assuming that the directions for turning lye into the boiler represented in Fig. 4 is the same as for turning lye into boiler Fig. 1, and that lye should be turned in so as merely to cover the axis of the

boiler, in that case what function of the diaphragm in the Keen boilers is performed by the earcap or cage in the boiler, in the Wise boiler, Fig. 4?

A. Under the assumption set forth in the question, both as to the directions referring to both boilers, and the direction being merely to cover the axis of the boiler, then the cage would not keep the material submerged; whereas, on the contrary, in Keen's the diaphragm would keep the material submerged, provided the boiler was so filled that the level of the liquid was above the diaphragm.

Q. 24. Where do you find the blow-off cock in the Wise apparatus, and what meaning do you give to the term blow-off cock?

A. I find it described in reference to Fig. 1 and the modifications thereof, and I give to the term this meaning, viz, a valve or cock so placed, in reference to a boiler, that, when it is opened, the material with which the boiler is charged may run out through the opening which the valve closes, or may be blown out if pressure is kept up in the boiler.

Q. 25. Is there any language used in the Wise patent which instructs you that anything but the liquid is to be drawn off through the valve-cock there described?

A. I think that the fair meaning of the language used, in reference to the revolving boiler, instructs that nothing but the liquid is to be drawn off through the valve, but I do not see how only the liquid can be drawn off without the application of a *seive* to the mouth of the blow-off cock, and no such *seive* is described. In the stationary modification of Fig. 1 there would be no way of getting out all the
338 material heated, (pulp,) except through the blow-of' cock described, but there is no language stating expressly that the material is to be so drawn off.

Q. 26. Is there any language in the Wise patent which instructs you that the solid contents of the boiler are to be discharged under pressure?

A. After referring to the patent I state that there is no statement that the solid contents are to be discharged under pressure.

Q. 27. In the boilers described in the Wright patent, where do you find the expansion-chambers?

A. In the upper parts of the boilers, above the upper pipes, and in the chambers below the man-hole plates or cocks.

Q. 28. Do you find any diaphragm in the boilers B and F of Wright's patent.

A. I do not.

Q. 29. Do you find any stirrers in either of these boilers?

A. I do not.

Direct resumed by Mr. Gifford:

Q. 30. Taking the direction as a whole, in Wise patent, in regard to the charging and treatment of material in boiler Fig. 4, what do you gather from them?

A. I gather from them that the cage or carcass is to be filled or partially filled with material, and sufficient lye is then to be introduced to cover the cage, either at the time of introduction or when the lye expands on being heated, the material to be treated being held submerged by the cage or perforated cylinder.

HENRY B. RENWICK.

Subscribed and sworn to before me, this 10th June, 1867.

R. E. STILLWELL,
Examiner.

EMIL VOSSNACK, recalled on the part of the defendant, deposes and says:

Q. 1. Look at papers now shown you, marked Exhibit 36, and state what it is.

339 A. It is a copy of an English patent, No. 1942, dated August 19th, 1853, granted to Watt & Burgess. It is copied from an English publication, and is for disintegrating and pulping vegetable matter.

Q. 2. Look at the two papers now shown you, marked, respectively, numbers 37 and 38, and state what they are.

A. No. 37 is a copy of a French patent granted to Messrs. Watt & Burgess, of London, September 28th, 1853, for improvement in the manner of disintegrating and reducing the pulp with vegetable substances. It is copied from the Brevet d'Invention, 2d series, vol. 29, pp. 189 and 190, printed in the year 1858. No. 38 is a translation into English of No. 37.

Q. 3. Look at the two papers now shown you, marked, respectively, Exhibit No 39 and Exhibit No. 40, and state what they are.

A. No 39 is a copy of a French patent granted to Messieurs. Coupier ot Méllier, of Paris, No. 5605, and dated May 17, 1851, for means to reduce vegetable fibrous materials to pulp suitable to the manufacture of white paper. It is copied from the Brevet d'Invention, 2d series, vol. 19, pp. 145, 146, and 147; printed 1855. Exhibit 40 is a translation into English of the same.

Q. 4. Look at the two papers now shown you, marked, respectively, Exhibits 41 and 42, and state what they are.

A. Exhibit 41 is a copy of a French patent granted to Mr. Clothan Breuil, No. 1440, dated February 12th, 1846, for the use of vegetable bark in the manufacture of paper. It is copied from the Brevet d'Invention, 2d series, vol. 6, pp. 60 and 61, printed 1851. Exhibit 42 is a translation into English of Exhibit 41.

Q. 5. Look at the two papers now shown you, and marked, respectively, Exhibits 43 & 44, and state what they are.

A. Exhibit 43 is a copy of a French patent granted to Monier Legoux, No. 6399, dated March 12th, 1839, for the manufacture of paper-pulp from every kind of wood, previously reduced to chips, bark, roots, leaves, grass-plant, reeds, tuberculous and leguminous root-pulp, wheat-straw, hay, grasses, mosses, etc., the whole by means of mechanical apparatus and new chemical process newly applied.

340 It is copied from the Brevet d'Invention, 1st series, vol. '52, pp. 413, 414, and 415, and plate 26, printed 1844. Exhibit 44 is a translation into English of Exhibit 43.

EMIL VOSSNACK.

Subscribed and sworn to before me, this 10th day of June, 1867.

R. E. STILWELL,
Examiner, &c.

HENRY B. RENWICK, recalled on the part of the defendants, deposes and says;

Q. 1. Have you read the two re-issues of the Watt & Burgess patent, printed at pages 26 to 32 of the bill of complaint in this suit, and the original patent upon which said re-issues were granted? If yea, what do you understand to be the invention which is described in said original patent?

(Objected to.)

(Complainant's counsel desires examiner to state the hour, 4 p. m., at which this examination is commenced; and objects to the examination of the witness upon the subject mentioned in the interrogatory, and upon any other subject not embraced in his previous examination.)

A. I have read the two re-issues, printed, as stated in the question, and also a copy, namely, Ex. K, purporting to be a copy of the original patent granted to Watt & Burgess, July 18, 1854. The invention described and specified in the original patent is a compound process for producing pulp from wood or other vegetable substances. The wood is first reduced to fine shavings or cuttings. Second, it is boiled in a solution of caustic alkali, as I understand, either under pressure or at that of the atmosphere; boiling under pressure being stated to be of considerable service. Third, the shavings are to be washed and pressed. Fourth, the shavings are now to be exposed to the action of chlorine or its compounds with oxygen for a time, determined by trial, the test being that the shavings will drop into a dark pulp when placed in a weak solution of caustic alkali. The pulp thus obtained, it is stated
341 may be washed and bleached by the usual or other processes described, and the invention specified is the pulping of wood, or reducing it to pulp by treatment in caustic alkali, then subjecting the shavings to the action of chlorine or its compound; and thirdly, the production of the pulp from the shavings, by submitting them, after being treated with chlorine to the action of weak caustic alkali.

Q. 2. State whether or not the invention described and specified as the invention of Watt & Burgess, in said re-issued patents or either of them, is the same or substantially the same as what is described as their invention in said re-issue' patent, and give your reasons briefly for any conclusions you may express thereon.

A. The inventions specified in the re-issued patents are not the same or substantially the same as that described in the original patent. In both the re-issues there is a statement that the wood shavings are to be boiled under a pressure corresponding to a temperature of at, near, or about 300 degs. Fahrenheit, in caustic alkali, and that such boiling will reduce the wood into pulp. There was no statement in the original patent that boiling, under pressure, or under such great pressure is essential; nor that any boiling in alkali will reduce shavings to pulp. That discovery is not even hinted at in the original patent, in which original, on the contrary, it is stated that the shavings, after being boiled are still shavings, and are only reduced to pulp by a subsequent treatment, both with chlorine and a weak caustic alkali, as the inventions specified in the re-issues are all based upon pulp produced from shavings by boiling in alkali under pressure alone, as there is no statement in the original that pulp can be so produced; but on the contrary, as before stated, the inventions described and specified in the re-issues are, in my opinion, different wholly from the invention described in the original patent, nor are any of them described in the original.

Q. 3. Have you examined and do you understand the contents of the copies of the French patent granted to Mr. Gros, Exhibits 28, 29, and the original thereof in the Brevet d' Inventions?

342 A. I have examined and understand the contents both of the exhibits and of the printed original, the latter being in the Astor library.

Q. 4. What is there described, and how does it bear upon the allege l invention described in the re-issued process, patent No. 1449, as to its being substantially the same or substantially different from that allege l invention?

A. In the Gros's patents, among other things, is described the boiling of wood and bark in solutions of caustic alkali, under pressure, after the fibres of the broom-plant have been rolled so as to make them stringy and cut up, the operation being something like that of crushing sugar-cane; and I consider this crushing and cutting to be equivalent to the reduction into shavings or cuttings described in the Watt & Burgess re-issue. Both the Gros's patent and the Watt and Burgess' patents give the strength of the caustic alkali in solution, but neither of them state the amount of the solution necessary to be used in the treating to a certain amount of wood. Both Watt & Burgess and Gros give approximately the time necessary for boiling in the solution. Gros says that it should be boiled at a pressure of from 3 to 4 atmospheres, and Watt & Burgess, at a temperature at, near, or above 300° of Fahrenheit scale. In my opinion, 290° Fahrenheit is within the limits prescribed by Watt & Burgess; and a pressure of 4 atmospheres, commencing with a perfect vacuum as zero, would give a temperature of from 293 to 294° Fahrenheit in pure water; and, as near as I can judge and remember, from experiments made some years ago by me, a temperature of 3 or 4 degs. higher in the alkaline solution described in Gros's patent. The temperature, therefore, which is described in Gros's patent comes within the limit of temperature prescribed by Watt & Burgess. Gros, like Watt & Burgess, describes the bleaching of the product resulting from the boiling in alkaline lye, under pressure, and in all these points, namely, of fine division of woody fibre, a boiling in caustic alkali for a certain time under pressure, and a subsequent treatment with chlorine. Gros and Watt & Burgess describe substantially the same process, and must therefore, describe the same resultant or product.

Q. 5. Have you read and do you understand, the contents of Exhibits Nos. 34 and 35?

343 A. I have read, and understand their contents.

Q. 6. How does the operation therein described compare with or affect the novelty of the alleged invention described in the said process, patent No. 1449?

A. The operations described therein, are the boiling of straw in strong lye, under a certain pressure, of from six to eight atmospheres, which would give a temperature from about 320 to 343 deg. Fahrenheit. The s atement is that straw thus treated is almost, as it were, dissolved; from which I should infer that it was reduced to a tolerably fine pulp, in so far as the boiling, under pressure, of woody fibre in strong lye is concerned, it is substantially the same as the process described in the patent No. 1449.

HENRY B. RENWICK.

Subscribed and sworn to before me, the 10th day of June, 1867.

R. E. STILWELL,
Examiner, &c.

EDWARD S. RENWICK, called and sworn as a witness on the part of defendants, deposes and says:

Q. 1. What is your name, age, residence, and profession?

Edward S. Renwick; 44 years of age and upwards; reside in the city of New York. I am a consulting engineer, and am engaged principally in soliciting patents for inventors, and in acting as expert in patent causes.

Q. 2. Have you read the copies of letters-patent granted to Morris L. Keen, for alleged improvements in boilers, which are annexed to the

bill of complaint in this case, and numbered, respectively, 25418, and 38901, and do you understand the contents of them?

A. I have read the copies referred to in the question, and believe that I understand their contents.

Q. 3. What do you understand to be described and specified as the invention of said Keen, in said patent, No. 25418?

A. The invention of said Keen, as described in the said patent, No. 25418, as I understand it, is a peculiar boiler for making paper-
344 pulp, constructed with an expansion-chamber, stirrers, and discharge valve or cock, arranged substantially as described in the patent for the purposes to be accomplished; that is to say, the expansion-chamber in a portion of the space within the boiler, which is separated from the remainder by a perforated diaphragm, which permits the passage of liquid, but prevents the passage of the solid matter, or material, to be operated on; the stirrers are arranged within the portion of the boiler that contains the solid material, so as to stir it or agitate it during the boiling. The discharge valve or cock is arranged at the bottom of the boiler, so that the contents may be discharged through it. The patent describes a peculiar arrangement of stirrers, which permits them to be moved out of the way of the material as it is thrown into the boiler; but I am not certain that this peculiarity of arrangement is one of the characteristic arrangements of the invention or not.

Q. 4. What do you understand to be described and specified as the invention of said Keen in said patent No. 38901?

A. The invention of said Keen, described in the patent No. 38901, consists, as I understand it, of two improvements in boilers for making paper-pulp; the first of these improvements is a boiler provided with a perforated diaphragm, (which divides it into an upper and lower chamber,) and a wall or perforated passage, extending from an opening, or charging hole on the upper part of the boiler through the upper chamber, (above the diaphragm,) to an opening in said diaphra'm, so that material introduced through the charging-hole can pass directly to the lower chamber of the boiler, (below the diaphra'm,) without falling upon the diaphragm, or choking its opening; the walls of the passage *are* "well," (as it is called in the patent,) preventing the 'terial so charged from coming in contact with the diaphragm. The second improvement, as I understand, consists of the combination of the said boiler with its diaphragm and wall, (or passage for the material,) with a discharge-pipe and valve at the bottom of the boiler for the purpose of permitting the contents of the boiler to be discharged.

Q. 5. Do you understand the construction of the boiler used by
345 the defendants, and which is alleged by the complainants to be an infringement of said Keen's patent? If yea, state from what sources you have derived information of it.

A. I believe that I do. I have received my information from the examination of Exhibit No. 36, and the explanations of Mr. George Gifford.

Q. 6. State whether or not the defendants' boiler, including the stirrers in it, is substantially the same, or substantially different from the boiler, described and specified in either of said Keen patents, and whether there is anything in defendants' boiler, which is described and specified in either of said patents as the invention of said Keen; and give your reasons for any conclusions you may express.

A. The defendants' boiler, as I understand it, is constructed substantially the same as the boiler specified in the specification in the Keen

patent No. 25418, unless that invention be limited to the peculiar arrangement of stirrers, described and represented in the drawings of the patent, which permits the stirrers to be moved out of the way of the material as it is thrown into the boiler, that is to say, the boiler of the defendants, as represented by Exhibit 36, has an expansion-chamber or portion of its space separated from the remainder by a perforated diaphragm, and has, in addition, stirrers of some kind, and a discharge-valve arranged at the bottom of the boiler to permit the discharge of its contents, but the stirrer is so arranged that it is in the way of material thrown into the boiler, so that said material would fall upon it. The defendants' boiler, as I understand it, is substantially different from each of the improvements set forth in the Keen patent No. 38901, because it has no wall or passage extending from the charging-hole through the space or upper chamber above the perforated diaphragm to an opening in said diaphragm for the purpose described in the said patent, or for any other purpose. In the defendants' boiler, on the contrary, the charging-hole is arranged below the perforated diaphragm so that the material is charged into the boiler below the diaphragm, and the use of a perforated well or any equivalent therefor for the purpose of preventing the material from falling upon the diaphragm is unnecessary.

346 **Q. 7. Have you examined, and are you familiar with the contents of the patent granted to Charles Wise by the government of France, May 12th, 1838, as described in the Brevet d'Invention, 1st series, vol. 43, pages 37, 38, 39, and 40, and the plates therein referred to? If yea, state what is therein described, and compare the leading features of it with the boiler described in said Keen patent, No. 25418, and explain the bearing or effect of the boiler or apparatus described in said Wise patent upon said Keen patent.**

A. I have examined what purports to be a copy of the patent of Wise referred to in the question; which patent is marked Exhibit 32, and also a translation of the same, marked Exhibit 33, and believe that I understand their contents. The said Wise patent describes two apparatus for treating rags and other materials employed in the manufacture of paper with an alkaline liquid, and the bleaching of them. The first of these apparatuses, as I understand it, consists of a boiler having suitable openings for the charging and discharging of its contents; which openings are provided with covers that may be tightly closed, also with a short pipe and stop-cock for the purpose of discharging the liquid contents; also with a stirrer or agitator for the purpose of stirring the contents of the boiler, and with a perforated pipe for the purpose of introducing steam into the boiler. The description states that the grating or stirrer may be oscillated to and fro a limited distance within the boiler, and that the boiler may be turned upon the shaft while the materials are under treatment within it. The description also states that said apparatus may be modified by placing two or more grates in the interior of the cylinder or boiler; also that the cylinder or boiler may be fixed, and the grate or stirrer made to turn, or that the cylinder may have an oscillating motion given to it. The description states further that the cylinder or boiler may be made to turn upon its transverse axis, and that the grate, which is the stirrer, may be modified to suit this arrangement.

The second apparatus described in the said Wise patent has a boiler with a cover sufficiently large to allow the introduction of an interior cylinder, which is described as a cylindrical cage, whose sides
347 have numerous small openings, so that it is a cylindrical dia-

phragm or partition inside of the boiler, and divides the space of the boiler into two chambers, the one within the cage, (for the material to be treated,) and the other outside of the cage, and into which the material under treatment is prevented from entering by the perforated walls of the cage. The interior of the cage is provided with points or teeth which project inwards, and the cage is provided with trunnions, which pass through stuffing-boxes in the ends of the boiler, and terminate in the journals, to one of which a gear-wheel is fitted, by means of which the cage may be turned. The cage is provided with an opening for the introduction of the material, and a cover by which the said opening may be closed. There is a representation in the drawing of what I understand to be a charging-hole and cover therefor on the upper side of the boiler.

The drawing shows a furnace by which the boiler is heated, and the description states that fire is kindled in this furnace. The description states that, after the operation upon the material is completed, the lye is drawn off, from which I understand that the boiler is provided with a pipe and stop-cock, such as are represented and described in reference to the final apparatus, and which are arranged at the lower side of the boiler. The description states that the apparatus may be modified as respects its form and the manner in which the necessary movement is to be imparted to the apparatus. When the said cage within the boiler is turned, the material within it is necessarily stirred or agitated by the points or teeth, which constitute the stirrers of the apparatus; the bearing or effect of the apparatus described in the said Wise patent upon the Keen patent, No. 25418, as I understand it, is to anticipate the invention set forth therein, as the invention of Keen, unless it be restricted to the peculiarities of the stirrers, viz., the arrangement of them so that they can be turned out of the way of the material as it is thrown into the boiler, and the arrangements of the discharge valve or cock, not only at the lower part of the boiler but also in connection with that portion of the space of the boiler in which the material to be treated is contained. Because one of the apparatuses described in the said
348 Wise patent has a boiler the space of which is divided into two chambers which are separated by the perforated cage or partition, so that the material under treatment is held submerged and prevented from passing into the outer chamber, which thus is, in substance, the same as the expansion-chamber described in said Keen patent, and the said apparatus has also a stirrer for the purpose of stirring the material, (which stirrers are the revolving points or teeth,) and has also a discharge-cock arranged at the lower side of the boiler.

Q. 8. Have you examined, and do you understand the contents of letters-patent of the United States granted to Lemuel W. Wright, March 27, 1847; and if yea, compare the boilers therein described and the leading features of patent No. 38901, granted to Morris L. Keen, and state the bearing or effect of the boiler or apparatus described in said patent to Wright upon said Keen patents, or either of them.

A. I have examined, and believe that I understand the contents of a certified copy of the patent of Wright referred to in this question. The said patent describes two boilers described by the letters B and F in the drawing, which are substantially the same with the boilers described in the two Keen patents referred to in the question; that they are closed vessels for the purpose of boiling straw and other fibrous substances under pressure in an alkali liquid; also that they have means for heating the material within them, and a pipe and stop-cock for discharging the contents from the lowest part of the boiler; but the said

boilers of the Wright patent differ from the boiler described in the Keen patent No. 25418 in the respect that the former have no perforated diaphragm or stirrers, and differ from the improvement described in the Keen patent No. 38901 in the respect that the said Wright boiler have no diaphragm, or well or perforated passage.

Adjourned to June 10, at 10½ o'clock.

349 MONDAY, *June 10th*, 1867.

Present, counsel for the respective parties.

Q. 9. Have you read the two re-issues of the Watt and Burgess patent, printed at pages 20 to 32 of the bill of complaint in this suit, and the original patent upon which said re-issues were granted, and do you understand the contents of the same?

A. I have examined certified Patent-Office copies of the two re-issues of the Watt and Burgess patent, and also certified Patent-Office copy of the original patent referred to, and I believe that I understand the contents of all of the same.

Q. 10. What do you understand to be the invention, and the only invention, which is described or made known in or by the said original patent?

(Objection by complainants, both to the form and substance.)

A. The only invention which I understand to be described in said original patent is a compound process for pulping and disintegrating shavings of wood and other similar vegetable matter, such compound process consisting of three operations performed in regular order and successively upon the shavings of wood. The first of the three operations is the boiling of the shavings in a solution of caustic alkali, with or without pressure. The second operation is the treatment of the shavings with chlorine, or the compound of chlorine with oxygen until the said shavings are so affected that they will fall into pulp when treated by a dilute solution of caustic alkali. The third operation is the treatment of the shavings that have been subjected to the two preceding operations with a weak solution of caustic alkali, whereupon they will fall into a pulpy mass of a dark brown color, thus completing the pulping and disintegration of the shavings. Each of the above operations is an essential part of the compound process constituting the invention set forth in the patent; and in following out the description of the patentees, the whole three operations must be effected,
in order that the pulping or disintegration of the shavings of
350 wood and other similar vegetable matter shall be accomplished.

In performing the first operation, which is preparatory to the other two, and fits the shavings to be penetrated by the chlorine or compound of chlorine and oxygen, the patent describes that the shavings are to be boiled in a solution of caustic alkali, and does not prescribe that boiling under pressure is essential, although it states that that kind of boiling is of considerable service. Hence if a person seeking to practice the invention should boil the wood shavings in a solution of caustic alkali in an open vessel, and were subsequently to treat them with the chlorine and weak caustic alkali in the manner described in the patent, he would practice the compound process described in the patent, which process, as I understand it, appears to be based upon the discovery that shavings of wood and other similar vegetable matter, so prepared as to be penetrated by chlorine or the compounds of chlorine and oxygen, will be so changed by the action of the chlorine or said compound, that they will fall into pulp, and be disintegrated when

treated by a weak solution of a caustic alkali. The patent describes that the dark pulpy mass obtained by the compound process above described may be bleached by the usual process, consisting substantially in subjecting the pulpy mass to the action of the hypochlorite of soda, or some other alkali, and then liberating the hypochlorous acid by the application of hydrochloric or muriatic acid, as it is commonly called. But this bleaching operation, as I understand it, is no part of the invention set forth, which is completed when the dark pulpy mass is obtained, upon the completion of the three operations which constitute the compound process.

Q. 11. Describe the article produced by that process.

(Objected to by complainants.)

A. The article produced is a dark pulpy mass, or a pulpy mass of a dark brown color, suitable to be manufactured directly into brown paper by the usual mechanical operations, or to be bleached so as to make white paper, when subjected to the usual mechanical operations; and this pulpy mass is the product due to the action of the chlorine upon the shavings of wood or other vegetable matter, and
351 their subsequent treatment by a weak solution of caustic alkali.

Q. 12. Are said two re-issued patents, or either of them, for the alleged invention of Watt and Burgess, described in the original patent, or any part thereof? Give your reasons in full and in detail for conclusions you may express in answer to this question.

(Objected to by complainants to form and substance.)

A. Neither one of said two re-issued patents is for the alleged invention of Watt and Burgess, or any part thereof. The invention set forth in re-issue No. 1449, as I understand it, consists of two processes, the first of which is a simple process consisting of the one operation of boiling wood or other vegetable substance in an alkali under a pressure of from 300 degrees, or thereabouts, to 500 degrees, whereby the material operated upon is at once converted into a pulp. The second process is a compound process consisting of the operations, the first of which is the first process above mentioned by me, and the second operation is the treatment of the pulp, thereby produced with chlorine and its compounds with oxygen. The second process appears to be limited to the treatment of resinous woods, and to the purpose of making white pulp for the manufacture of paper from such woods.

Both of the said processes appear to be based upon the discovery that wood is converted into pulp or disintegrated by the single operation of boiling it in a caustic alkali at a sufficiently high pressure, equivalent to a temperature of from about 300 to 500 degrees, without any subsequent operation. No discovery or suggestion or indication of such a discovery is set forth in the original patent of Watt & Burgess; but, on the contrary, a substantially different discovery appears to be the basis of the invention or compound process described in that patent, namely, that wood shavings, when sufficiently penetrated by chlorine, will drop into pulp when treated by a weak solution of caustic alkali. No description or indication or suggestion is given in the original patent that the shavings of wood should be boiled in a caustic alkali not below a pressure corresponding with a certain high temperature, (300 degs. or thereabouts,) or that such boiling would convert
352 the wood shavings into pulp, without the subsequent treatment by chlorine and weak caustic alkali; but, on the contrary, the original patent, by directing that the wood shavings are to be boiled in the alkaline solution, without designating any pressure at which they are to be so boiled, by denominating them, after such boiling, as

"shavings," (not pulp,) and by stating that the conversion of the shavings into pulp is produced by the action of the chlorine and weak alkali, distinctly prescribes the last two operations as pulping operations proper, and the first operation of boiling in alkali as merely a preliminary operation to prepare the "shavings" for the other two operations. The first process or single operation described in the said re-issue No. 1449 is thus a substitute for the compound process of three operations described in the original patent, and is not only not a part of said compound process, but is a substantially different process, enabling two of the essential operations of the process described in the original patent to be dispensed with in producing pulp from shavings of wood and other similar vegetable matter. As the second process of said re-issue, No. 1449, comprehends the first process (that is, the peculiar boiling in caustic alkali under a pressure corresponding with a temperature of about 300 degs. or upwards to 500 degs.) as the first of the two essential operations of which such second process is composed, and, as such first process is not described, indicated, or suggested in the original patent, the said second process is necessarily substantially different from the compound process set forth as the invention in said original patent, and is no part of said compound process.

The invention set forth in re-issued patent No. 1448, as I understand it, is a new article of manufacture, consisting of a pulp produced from wood or other vegetable substance by boiling the same in an alkali under a pressure corresponding with a temperature not less than about 300 deg's, or upwards to 500 deg's, without subsequent treatment. Such a product is nowhere described or suggested in the original patent of Watt & Burgess; but, on the contrary, there is described in that original patent a different product, namely, a pulp or pulpy mass of a dark brown color, which is the result of the action of chlorine and a
353 weak solution of caustic alkali upon shavings of wood or similar vegetable matter prepared for such action by a preliminary boiling in caustic alkali. The only other product having the form of pulp described or suggested in the said original patent, is the bleached product obtained by subjecting the dark pulpy mass to the bleaching operation, which is necessarily a substantially different article from the unbleached pulp obtained by boiling shavings of wood in caustic alkali under a pressure corresponding with a temperature of from about 300 to 500 degrees; first, because the intermediate product is obtained by the pulping action of chlorine and a weak solution of caustic alkali, and, secondly, because the bleaching produces certain chemical changes in the material which are not effected by boiling the material in caustic alkali at any pressure, high or low. There is a material described in the said original patent, as the product of the first operation of boiling in alkali, but that product is described as "shavings," and after washing and pressing as "damp shavings," which is necessarily a substantially different article from a "pulp," and therefore, the pulp described as the product of boiling wood shavings in the caustic alkali at the temperatures prescribed in the re-issued patent No. 1448, is therefore, a substantially different article from the shavings which are the product of the boiling in the caustic alkali described in the said original patent.

Q. 13. Have you examined, and do you understand the contents of the copy of the French patent, granted to Mr. Gros, Exhibit No. 29?

A. I have examined the copy of the French patent, or more properly the translation of the same, marked Exhibit No. 29, referred to in the question. I have also examined the publication of the French patent of Gros in the Brevet d'Invention, of which Exhibit No. 29 appears to

be the translation, and I believe that I understand the contents of the same.

Q. 14. What, if anything, is therein described which bears upon the alleged invention described in the re-issue process, patent No. 1449 and explain in what way, if at all, it affects or compares with said alleged invention.

(Objection by complainants.)

354 A. The said patent describes, among other things, the reduction of the woody matter of the broom-plant to a state similar to oakum and the cutting of it up into small pieces; also the boiling of the said woody material in caustic alkali with a pressure of from three to four atmospheres, which would correspond with a temperature of from about 278 to about 298 degrees. It also describes the treatment of the material after it has been boiled twice in the caustic alkali, under pressure with chlorine-gas. As the Gros patent does describe the boiling of the reduced woody matter in a solution of caustic alkali and under a pressure which is substantially within that prescribed in the re-issue patent No. 1449, it describes substantially the same process, as the first of the two processes set forth in that re-issue patent; and as the said Gros patent describes the treatment of the said woody matter with chlorine after it has been so boiled, under pressure, in the caustic alkali, the said Gros patent describes substantially the same process as is set forth as the second process in said re-issued patent No. 1449. I have said that the pressure prescribed in the Gros patent is substantially within that prescribed in the re-issued pat*e*rn No. 1449, because I do not understand the words "at, near, or above 300°" in said re-issued patent, to limit the lowest temperature to precisely 300°, but that a temperature a little lower than 300°, say down to 290°, will be substantially within the description of said re-issued patent; and as the temperature of pure water when boiled under a pressure of four atmospheres, measuring from a vacu'm as zero, would be about 294°, and the temperature of a solution of alkali boiled under the same pressure, would be three or four degrees higher, say 297° or 298°, and the Gros patent prescribes the boiling of the woody material in a solution of caustic alkali, under a pressure of four atmospheres, the pressure and temperatnre described in said Gros patent are within the pressure and temperature described in said patent No. 1449, and therefore, the Gros patent describes the invention set forth in said re-issued patent No. 1449.

Q. 15. Have you read and do you understand the contents of Exhibits 34 and 35?

A. I have, and believe I understand their contents.

355 Q. 16 How does the operation therein described compare with or affect the novelty of the alleged invention described in said process, patent No. 1449?

(Objection by complainants.)

A. The said exhibits describe, among other things, that straw is once or more boiled in a strong lye, under a pressure of from six to eight atmospheres, and consequently almost, as it were, dissolved. A pressure of from six to eight atmospheres, measuring from a vacuum as zero, would correspond with a temperature varying from 322° of Fahrenheit's scale to 347 degrees or thereabouts, varying a little with the strength of the lye. By the words "strong lye," in these descriptions I understand a solution of caustic alkali, because, so far as I know, the strong lye universally used by paper-manufacturers at the dates of the publication of the exhibits was a solution of caustic alkali. Therefore, as I

understand the said descriptions, they describe the process of treating a vegetable substance by boiling in an alkali, under pressure, as a process or preparatory process for making pulp for the manufacture of paper from such vegetable substance, which is described as the first process in the said re-issued patent No. 1449; the pressures corresponding with the temperatures 322 deg. and 347 degrees, being within the pressures corresponding with the temperatures at, near, or above 300 deg. up to 500 deg. prescribed in said re-issued patent.

Q. 17. Do you know what is the effect produced upon wood-fibre by subjecting it to a temperature of from 400 deg. to 500 deg. Fahrenheit? If you do, state what would be the effect.

A. I do, from experiments made by me some years ago. I had occasion to subject wood to a steam-heat at a temperature of about 380 deg., and the effect was to convert it into charcoal, from which I infer that subjecting it to a temperature of from 400 deg. to 500 deg. would produce the same effect, the lowest of these two being higher than the temperature at which I experimented:

Cross-examined:

Q. 1. When were you first requested to examine the patents referred to you in your direct examination for the purpose of testifying in this case?

356 A. I was first requested to examine them for the purpose of testifying in this case some time previous to last Tuesday, June 4; but I think it is proper to state that I had examined the greater part of them long previous to that date, for the purpose of testifying in another case.

Q. 2. In what other case?

A. I do not know the title of it, but I was requested to make the examinations by Mr. Howland, of the firm of Howland & Palser, so as to prepare myself to testify in some case in which he either was or expected to be engaged. I do not now recollect which he said. It was two or three years ago.

Q. 3. Have you made any chemical experiments since last Tuesday to test the correctness of any matters concerning which you have testified?

A. I have not.

Q. 4. Is not the operation or process described in the original American Watt & Burgess patent purely chemical?

A. As I understand it, it is.

Q. 5. Are not the operation or operations described in the original patent, No. 1449, purely chemical?

A. As I understand them they are.

Q. Is not the product described and claimed as the invention of Watt & Burgess, in re-issue patent No. 1448, the result of purely chemical process?

A. As I understand it, it is; and I think I should add that it is the product of a single operation constituting such chemical process.

Q. 7. Have you seen and examined the pulp, and the paper made from the pulp which is claimed to be the result of this chemical process?

A. I never saw pulp or paper made from either pulp which I know to have been the result of the said chemical process; but I have seen dried sheets of paper-pulp which I was informed had been produced by such process at an establishment near Philadelphia.

Q. 8. Have you any doubt that pulp suitable for the manufacture of paper, such as you now see in the exhibit marked Exhibit F. C.

357 Nye, E. S. R., can be produced from wood by the process described in re-issued patents Nos. 1448 and 1449.

A. I have not, provided the heat be maintained below the point at which wood fibre is charred. If the heat were carried above 400° to 500°, as described in the patent, I have no doubt that such paper could not be produced by the said process.

Q. 9. Have you any doubt that pulp suitable for the manufacture of paper can be produced from wood boiled in a strong caustic alkaline solution, at a pressure considerably less than the temperature 300°, or in an open vessel, if the product of this first boiling be treated with chlorine or its compounds with oxygen, and with or without a subsequent alkaline treatment, according to the nature of the wood?

A. I have doubts as to whether pulp suitable for the manufacture of paper, can be produced from wood boiled in a strong caustic alkaline solution in an open vessel, or at a pressure considerably less than 300°, if the product be treated with chlorine or its compounds with oxygen, without subsequent alkaline treatment; and when making this statement I understand a strong caustic alkaline solution to be one of a density of from 10° to 15° of Beaumé, which would be a strong solution compared with that usually employed by paper-makers. What the effect of a saturated solution of a caustic alkali upon wood would be I do not know, as I have never tried such a one, nor seen an account of the result of such a trial. I also understand that the question has reference to the production of the pulp by the operation referred to in it, and without performing some supplementary operations upon the material.

Q. 10. Have you any doubt that pulp suitable for the manufacture of paper can be produced by the process described by you in your answer to direct interrogatory 10?

A. I have not.

Q. 11. In giving that answer, did you not assume that the first of the operations referred to may be performed in an open vessel?

A. I did; and I should also state that I also assumed it might be performed in a closed vessel.

Q. 12. Do you consider the specification of the original Amer-
358 ican Watt & Burgess patent a sufficient description of the mode of making paper pulp from wood, described by you in your answer in the 10th interrogatory?

A. I do; but I am not prepared to give any opinion as to the quality of the paper-pulp made by it, as I have never seen the process practised.

Q. 13. Have you, in your direct examination, been referred to any patent or work by which a pulp suitable for the manufacture of paper has been produced from wood by a purely chemical process?

A. Understanding that the interrogatory is limited to the peculiar vegetable material called "wood," and excludes the mechanical washings, I have not been referred to any patent or work by which a pulp suitable for the manufacture of paper has been produced from "wood" by a purely chemical process.

Q. 14. So far as anything exhibited to you in your direct examination is concerned, such a product from wood would be new, or a new article of manufacture, would it not?

A. I am not prepared to say whether it would or would not be, because the article so produced may, for aught I know to the contrary, be identical with the product obtained from woody matter by processes described in the patents or works that I have been referred to in my direct examination.

Q. 15. If not identical with those would it not be a new product?

A. So far as I know it would.

Q. 16. Do you find any claim of this product as a new manufacture in the original American patent of Watt & Burgess?

A. I do not.

Q. 17. Do you know of any difference between pulp produced from wood by the process described in your answer to direct interrogatory 10, and that produced by the single process described by you in your answer to direct-interrogatory 12, as the first process described in reissue No. 1449?

A. I have not made any tests for the purpose of ascertaining whether there is or is not any absolute difference, chemical or physical,
359 between pulps produced from wood by the two processes referred to in the question; but I have no doubt that there would be a difference between the two, because the chemical processes, to which the wood is subjected to make the two pulps, are substantially different, and I have no doubt that if no other operation be performed upon the material than the said two processes, the two pulps will differ in their chemical constitutions.

Q. 18. Do you not know that the fibre to be obtained from wood for the purpose of manufacturing paper is what is termed pure cellulose?

A. I do not. I know that the ultimate fibrous matter that can be obtained from wood is pure cellulose, but I doubt whether it is ever obtained in the manufacture of ordinary paper.

Q. 19. Supposing it to be obtained, does it make any difference by what chemical or other process it is obtained?

A. It does not, so far as the chemical constitution of the article is concerned.

Q. 20. Then if the tests disclose that the results produced by the single operation of boiling in alkali at a high temperature, and also by boiling in alkali at a low temperature, and subsequent chlorine treatment, or subsequent chlorine and alkaline treatment be the same, the difference spoken of by you in your answer to the 17th cross-question would not exist?

A. As I understand your question it would not, because the result obtained in each case would be the well-known chemical substance called cellulose.

Q. 21. Is not the object of the chemical treatment of wood or any substance for the production of pulp for the manufacture of paper, the removal of the intercellular tissues of the substance submitted to the chemical agencies?

A. This is one of the objects; another object is the decoloration or bleaching of the product.

Q. 22. Is it not pulp fitted for the manufacture of paper as well before as after it is bleached?

A. It may be suitable for the manufacture of brown paper.

Q. 23. It will be so, if it be pure cellulose, will it not?

360 A. No. I should say that if it were pure cellulose it would be suitable for the manufacture of white paper, because pure cellulose is white.

Q. 24. Will it not be fit for the manufacture of brown paper if all the intercellular matter be removed?

A. If all, (by which I understand every particle,) of the intercellular matter be removed, I doubt if the pulp would be fit for the manufacture of brown or any other paper on account of the exceeding minuteness of the cellulose matter remaining. If so much of the intercellular matter be removed, that the pulp, while fine enough to make good

paper, has still the fibrous character, then it would be fit for the manufacture of brown paper.

Q. 25. Have you ever made any experiments to ascertain the proportion of cellulose by weight, fit for the manufacture of paper, that can be obtained from wood, straw, or other similar vegetable substances?

A. I have not myself, because I have relied in such matters upon the statements of chemists who have made the requisite experiments.

Q. 26. According to your understanding of the original Watt & Burgess patent, as given by you in your direct interrogatory 10, the simple process referred to by you in your answer to direct interrogatory 12, as the first of the processes described in re-issued patent No. 1449, is not described in said original specification. Do I state your answer correctly?

A. I believe you do.

Q. 27. Then it is your opinion, is it not, that if some one had boiled shavings of wood in a caustic alkaline solution of the strength indicated by 12 deg. of the English hydrometer in a close vessel, capable of sustaining a pressure equal to that caused by a temperature of 300 deg. or more in the alkaline solution, and thereby produced pulp, he would not have infringed the original Watt & Burgess patent?

A. That is my opinion.

Q. 28. If that specification had stated that pulp could be produced from chips or shavings of wood in a caustic alkaline solution of the strength stated in the last question at a high pressure, would the condition in the last question be an infringement of such a patent?

361 A. Certainly not, unless the claiming clause confined the invention to the production of pulp by that one operation. If the specification had made a statement substantially such as is stated in the question, but had in addition stated that the invention consisted of a process for making paper by treating wood shavings with caustic alkali, chlorine simple or its compound with oxygen, and alkali in the order substantially as described, the person who only boiled the shavings of the wood in the alkaline solution would not have infringed the invention.

Q. 29. If the claim had included, or a separate claim had been inserted, so as to include the production of pulp by boiling in the alkaline solution, as described in the two last questions, at a high pressure, would it not then have been an infringement?

A. If there had been a special claim to the production of pulp by boiling in the alkaline solution as described, the person who should boil wood shavings in the alkaline solution of the strength indicated would have infringed upon the invention, whether he boiled them at a high or at a low pressure; because, as I understand the description in the patent, boiling in the alkaline solution at any pressure is within that description.

Q. 30. If Watt & Burgess, prior to the date of their English patent, had actually produced pulp suitable for the manufacture of paper from wood by boiling chips or shavings of wood in a strong caustic alkaline solution at a high temperature, would you not consider the specification of the original American patent, as you have stated the substance of it in your answer to direct interrogatory 10, defective and insufficient, in not describing and claiming this result?

A. No, I should not. I should consider it, as I now do, a description of a substantially different invention from that referred to in the question.

Q. 31. In giving the last answer, do you assume the pulp obtained by

the single operation, and that which is the result of the process described by you in your answer to direct interrogatory 10, to be the same or different?

A. I made no assumption as to the quality of the pulp. My answer was based upon the difference between the process or operation
362 described in the 30th cross-question and the compound process described in the original Watt & Burgess patent.

Q. 32. In giving the answer to your 30th cross-question you had no regard then to the result sought to be obtained by either process, whether it was the same or different?

A. If the word "result" be used to mean the product of the process, I had no regard to it in giving my answer to the 30th cross-question; as I understood that question at the time, I understood the result referred to in the last part of the said question as meaning the process of producing pulp by the single operation of boiling the shavings in the strong caustic alkaline solution at a sufficiently high temperature for that purpose. If, by the word "result" in that question, be meant the product of the operation, I should still say that the original Watt & Burgess patent was not defective and insufficient in not describing and claiming a result that was obtained by a process substantially different from anything that is described in it. If the product obtained by the process described in the invention, in the original Watt & Burgess patent, were a product possessing new properties, then I think that Watt & Burgess would have had a right to have taken out a separate patent for such product, describing it by its properties or distinguishing characters, and they erred in not doing so.

Q. 33. Then, if the product were the same by the two processes, do you not think that they erred in not taking out a patent or patents for both processes, as well as for not taking out a patent for the product, supposing all these to be new, and of their invention?

A. I think that they did, as by neglecting to do so they gave two of the three inventions to the public.

(The latter part of answer objected to.)

Adjourned to 10½ a. m., the 11th inst.

363 TUESDAY, *June* 11, 1867.

Present, counsel for the respective parties.

Mr. Nye, for the complainants, states that they will not pursue the cross-examination of the witness further, inasmuch as the time for taking testimony has expired, and further examination might delay the printing of the testimony, and the hearing of the cause.

Defendants' counsel states that he yesterday stated to the complainants' counsel that he could proceed with the cross-examination of the witness to-day if he wished, and now, June 11, 1867, at 11 a. m. tenders Messrs. E. S. Renwick & H. R. Renwick, the witnesses, for further cross-examination.

E. S. RENWICK.

Subscribed and sworn to before me, this 11th day of June, 1867.

R. E. STILWELL,
Examiner.

In the circuit court of the United States for the eastern district of New York.

THE AMERICAN WOOD-PAPER COMPANY
vs.
THE FIBRE-DISINTEGRATING COMPANY. } In equity.

Depositions of witnesses on behalf of the complainants in the above cause, taken pursuant to special order of said court, and pursu-
364 ant to due notice, before Henry Phillips, jr., esquire, a commissioner of the United States in and for the eastern district of Pennsylvania, special examiner appointed by said court according to order of said court, dated New York, June 6th, 1867, at the office of the said commissioner, No. 524 Walnut street, in the city of Philadelphia.

JUNE 10, 1867.

Present, Henry E. Wallace, esq., counsel for complainants; George Harding, esq., counsel for defendants.

B. HOWARD RAND, M. D., a witness for the complainants, being recalled and duly sworn, doth depose and say, in answer to the several interrogatories:

Q. 52. What is your name, age, residence and occupation?

A. B. Howard Rand, M. D.; age, 39; residence, 1615 Sumner street; am a professor of chemistry in Jefferson Medical College.

Q. 53. Are you the same person who was examined in this cause, on the part of the complainants, on the 8th day of February, A. D. 1867?

A. I am.

Q. 54. In your answers upon that examination to the 8th, 46th and 48th, and other interrogatories, you refer to experiments of your own and their results in reference to the various pressures corresponding to the various temperatures in boiling distilled water alone, and vegetable substances in caustic alkaline solutions of various strengths. Have you made any table or minutes of such experiments and results. If yea, please produce and annex the same to your deposition, and state how these experiments were made, and whether the results as stated were correct?

A. The tables, which I submit, marked Exhibit "A and B," contain, in the first column, the safety-valve pressure in pounds—that is
365 above atmospheric pressure; the second column is taken from a treatise on steam and locomotion, by John Sewell, London, 1852, page 211—it is the average of various experiments made by the French Academy, Franklin Institute, and others; the third column contains the result of experiments made by me and Dr. C. M. Cresson last year on water. Those numbers accord closely with those of Sewell; the fourth, fifth and sixth columns give the results of alkaline solutions of two (2) degrees Beaumé, five (5) degrees Beaumé, and twelve (12) degrees Beaumé. To these alkaline solutions was added wood, in the proper *por*portion for pulping. Into the liquid was inserted a cup, screwed into the boiler, containing mercury and a verified thermometer; a pressure-gauge was attached to the boiler; the thermometer and *gua*ge were simultaneously observed by two (2) observers, and, noted. The heat was run up very gradually, and I believe the results to be accurate. The bottles marked 1, 3, 4, 5, 6, 7, 10, 12, 13, 22, and 23, contain specimens of the product of the various operations referred to in said tables.

Q. 55. Have you examined, and are you familiar with the patent granted to Lemuel Wellman Wright, by the government of England,

dated April twentieth (20th,) 1825? and if so, state what you understand to be the characteristics and purposes of the invention therein described; whether such patent is for the same, or substantially the same process and invention as that described and claimed in the specification and claim of the Mellier patent mentioned in the 48th (forty-eighth) interrogatory of your said former examination; and if not, state why not; and state fully wherein said Mellier invention differs from the above-mentioned patent of Lemuel Wellman Wright, and in what respects the said Mellier patent is for a new, distinct and separate invention?

A. 55. I have examined the patent of Lemuel W. Wright, dated April 20, 1825, No. 5144, (five thousand one hundred and forty-four.) It is for washing fabrics preparatory to bleaching. The goods are steamed under a pressure of fifty (50) pounds for half an hour. Soap and water or alkali, probably not caustic, is forced through them whilst in pressure—
the pipe from the vessel containing the soapy or alkaline solution
366 coming from its bottom and regulated by a stop-cock. The steam
is admitted above the surface of the liquid; forcing it through this pipe; the liquor having been forced through the material to be cleansed passes into a vessel situated below, whence it may be raised by steam-pressure exerted above its surface into the original vessel. This patent differs from the Mellier patent in that the object is to cleanse, not to disintegrate, nor to pulp the rags. Mellier's specification calls for a caustic alkaline solution, definite in quantity, and has for its object the conversion of straw and other vegetable fibrous materials into pulp suitable for the manufacture of white paper. This it does at a single operation and by a chemical means.

Q. 56. Have you examined, and are you familiar with the patent granted to Lemuel Wellman Wright by the Government of the United States, on the 27th day of March, 1847? and if so, state whether such patent is for the same or substantially the same process as that described and claimed in re-issued patent No. 1449 (the Watt & Burgess patent,) and whether the article produced is the same, or substantially the same as that described in re-issued patent No. 1449, for a new manufacture; and if not, state why not; and state fully wherein the re-issued patent differs from the last above-mentioned patent of Lemuel Wellman Wright, and in what respects they are for distinct and separate inventions.

A. 56. I have examined the said patent. It is substantially the same as the English patent referred to in answer 29. It differs from the re-issued patent No. 1449 in that the process is rather a mechanical disintegration than a chemical one—the disintegration being effected by grinding. Weak alkiline solutions and a comparatively low temperature are employed. He speaks of grinding or pulping, as if these terms were synonymous. He does not refer to wood.

Q. 57. Have you examined and are you familiar with patent granted to Lemuel Wellman Wright, by the Government of the United States, on the 27th day of March, 1847? and if so, state whether such patent is for the same, or substantially the same process and invention as that described and claimed, and the specification and claim of the said Mellier patent; and if not, state why not; and state fully wherein said
367 Mellier's invention differs from the last above-mentioned patent of Lemuel Wellman Wright, and in what respct the said Mellier patent is for a distinct and separate invention?

A. 57. I have examined the said patent. It differs from the Mellier patent, which converts straw and similar vegetable fibrous substances into pulp suitable for the manufacture of white paper, by a single chemical operation; bleaching only being necessary afterwards.

Wright's process is a complex one, depending rather upon mechanical than upon chemical means for disintegrating straw. Mellier gives a fixed preparation of alkali, and specifies certain degrees of temperature, which, from the construction of Wright's boiler, I believe to be higher than those used by him.

Q. 58. Have you examined the specifications of the patents granted in the United States to Morris L. Keen, bearing date the 13th September, 1859, and 16th June, 1863, and do you understand the same. If so, state whether the boilers and apparatuses described in the last-mentioned patent of Lemuel Wellman Wright are the same invention as is described and claimed in either of said patents to Keen, and describe fully the characteristics and purposes in which they differ?

A. 58. I have examined said specifications and understand the same. The boilers resemble each other in one respect; the contents are discharged through an opening in the bottom of the boiler, under steam-pressure; both boilers are vertical. There is no other resemblance.

Wright's boiler does not contain the perforated diaphragm and its appurtenances. Wright's boiler lifts its contents by steam-pressure into a vessel placed above.

Keen's boiler discharges its contents into the open air by the pressure of steam generated in the boiler itself, and, as in Wright's boiler, from a separate boiler. The object in Keen's boiler is by the rapid expansion of the steam, to separate the fibres of the material which has been already chemically disintegrated, thus much facilitating subsequent washing by percolation. Wright does not wash by percolation.

368 The discharge-valve in Keen's boiler is internal; in Wright's boiler the stop-cock is external and beneath the boiler.

Q. 59. Have you examined and are you familiar with the following publications? that is to say:

Berlage, Zu No. 35, Central Blattes für Deutsch papier-fabrikation, No. 35, May 15, 1852, at page 15 and note on said page.

Central Blatte upon the manufacture of paper in Germany, No. 27, September, 1852, page 449, three communications. Article upon the manufacture of paper from cloth, waste, and straw, in England.

Industrie Anstellung. Zu London, 1857, vol. 2, pages 329 to 342, and especially page 342, note 4, note 8; and if so, state whether either or any of said printed publications describes the same or substantially the same process as that described and claimed in re-issued patent No. 1449, (the Watt & Burgess patent,) and whether the article produced, as described in either or any of said printed publications, is the same or substantially the same as that described in re-issued patent No. 1449 for a new manufacture; and if not, state why not; and state fully wherein the said re-issued patents differ from each of the processes and products described in said printed publications, and in what respects the said re-issued patents are for new, distinct, and separate inventions?

A. 59. I have examined the said publications. In Central Blatte, May 15, 1852, there is a notice of Gustave Schauffelens having introduced the closed boiler and high-pressure steam. There is nothing to lead us to infer that he boiled anything but rags. Central Blatte, September 27, 1852, in a notice on making paper from straw, the author states, that in England straw is boiled once or more in strong lye, under six (6) to eight (8) atmospheres, and then quotes Lemuel W. Wright as a successful maker. He does not allude to any patent or before-published process under which this operation is carried on. There must be some error in his statement, as straw is pulped easily with weak alkali at a pressure of six (6) atmospheres. Then he states that the straw is to be boiled

or oftener in a strong lye, at a pressure of from six (6) to eight (8) atmospheres. Wright's process is more or less a compound
369 one, in which he does not trust to the boiling in alkaline solutions alone. Wright uses weak solutions, and does not state the pressure he uses, which, from the nature of his apparatus, was probably considerably below the lowest of these pressures. It is not usual to allow visitors to chemical works to know the actual strengths of solutions or pressures used. The hydrometer, thermometer, and *gua*ges are made to indicate falsely, or are "blind." The proprietors or firemen only know their true meanings.

As to the extract from the Industrie Anstellung, Zu London, 1851: on the last page is an allusion to straw-paper. After stating that a firm, beautiful paper is made from cotton and linen waste, the writer refers to straw paper, by saying that the new appearance of this paper at the exhibition, 1851, may be taken as a sign that the making of the finer sorts out of this material, (straw,) though it may be practical and feasible, yet it accomplishes no economical results, and therefore will not be carried further. In foot-note 8, the same statement as to boiling straw in strong lye, under pressure, as that alluded to in answer No. 28, is made. The remark in that answer will apply in this case.

Q. 60. Have you examined and are you familiar with the following printed publications? that is to say:

Berlage, Zu No. 35, Central Blattes für Deutsch papier-fabrikation, No. 35, May 15, 1852, at page 15, and note on said page.

Central Blatte upon the manufacture of paper in Germany, No. 27, Sept., 1852, page 449, three communications. Article upon the manufacture of paper from cloth, waste, and straw in England.

Industrie Anstellung, Zu London, 1851, vol. 2, pages 329 to 342, and especially page 342, note 4, note 8.

If so, state whether either or any of said printed publications describes the same or substantially the same process as that described and claimed in the specification and claim of said Mellier patent; and if not, state why not; and state fully wherein said Mellier invention differs from each of the processes described in said printed publications, and in what respects the said Mellier patent is for a new, distinct, and separate invention.

370 A. My answer to this interrogatory is the same as to the last one.

Q. 61. In your answer to interrogatory No. 40, you say that when a vegetable substance is completely pulped, that is, when the whole of the intercel ulose is removed, very slight mechanical action is sufficient to separate he already isolated fibres. What is meant by "very slight mechanica action?"

A. When wood-pulp is blown from the boilers the form of the chips is entirely lost. The specimen which I present (marked Exhibit 24, H. P., j'r.,) was obtained by me from the complainants' works at Manayunk. It is pulp after it has been blown from the boiler, and washed by a stream of water from a hose. When the pulp is drawn from the boiler it retains the form of the chips, but falls to pieces by the action of a stream of water used in washing, and may be crushed between the finger and thumb.

Q. 62. In your answer cross-interrogatory five (5) you state that the pulp, after having been washed, is passed through a rag-engine. What is the object of this operation?

A. It is to mix the pulp with water to such a consistence as to enable it to be pumped into a tank. At Royer's Ford the rag-engine is not used, and the pulp is mixed by means of a wooden dasher. The beating,

after bleaching it, is to enable the fibres to felt. It is necessary in pulp of all kinds, whether made from wood, rags, or other material.

Q. 63. Have you made an experiment with broom?

A. Yes. I boiled half an ounce of the woody part of broom with twenty (20) fluid ounces of a solution of caustic soda at 9 (nine) deg. Beaumé for two hours, at a pressure of about 45 (forty-five) pounds. It was softened but not disintegrated. I submit a specimen of the product, (Exhibit 25, H. P., j'r.) The proportion of alkali to wood in this case was two hundred (200) per cent., being ten (10) times that to pulp poplar at the proper temperature, and the time was double that required for the same in the experimental boiler.

Q. 64. Please identify the variety of the sample of broom used?

371 A. The broom used was obtained, through Mr. Buist, from, I understood, Mr. Eastwick's grounds, formerly Baitram's gardens. I have gathered the plant, myself, and recognized the sample which I used as being the officinal "scoparius." Its French synonyme, as given in the United States Dispensatory, is "Genet a Balais." The plant is fully described in that book.

Q. 65. What portion of the plant was used by you in the experiment you have spoken of?

A. The woody part, being previously deprived of its bark and cut into pieces laterally, not split.

Cross-examined by Mr. Harding for defendants:

Q. 1. What practical experience or acquaintance have you had in the manufacture of paper or paper-pulp?

A. Only that obtained by visits to the works of the American Wood-Paper Company, and experiments made during last summer and fall.

Q. 2. When and how often did you visit the works of the American Wood-Paper Company?

A. I think I visited the works five times. I cannot give the dates, but during 1866.

Q. 3. On what kind of material were they operating when you visited the works?

A. In one department on poplar wood, in another on straw.

Q. 4. Are those the only materials you have ever seen practically operated upon in the manufacture of pulp?.

A. In the straw-mill some rags and rope were being made into pulp, also for the purpose of admixture. These are all the materials that I have seen operated on.

Q. 5. Describe, so that a person acquainted with the art of paper-making could carry out the process of making white paper from the log of poplar wood, as you saw it done.

A. The log is freed from its bark, cut into chips by revolving blades, driven by water-power. 2d. The chips are put into vertical boilers provided with a man-hole at the top, and a perforated diaphragm at a short distance below the top, with a blow-out. The object of the diaphragm is to keep the wood submerged in the alkaline solution which is afterwards added, and at the same time to allow of the expansion of the liquid by heat. At or near the bottom of the boiler is a valve or

372 cock, by means of which its contents may be discharged. The chips having been put into the boiler, a warm solution of caustic soda, of a strength of about 12° Beaumé is introduced so as to cover the chips. The exact quantity used will depend upon the dryness or greenness of the wood, a less quantity being required for green than dry wood. Sixty per cent. of the weight of the dry pulp is the quantity of caustic soda used. One-third of this quantity will be the average

amount required for wood, that is, 20 per cent. of the weight of the wood in caustic soda. The solution of caustic soda is prepared as follows: Soda-ash, that is, commercial carbonate of soda, is dissolved in water in the proportion of a pound to the gallon, and boiled with half its weight of good lime previously slacked. I do not remember the length of time that the boiling is kept up at the works; a very simple test, however, shows when the operation is completed. If a few drops of acid be added to a portion of the solution and no effervescence occur, the liquor is caustic. The carbonate of lime formed during the operation is allowed to settle, and the clear alkaline liquid raised by centrifugal pumps up into a tank which is above the boilers, where it is warmed by the waste heat.

(Mr. Harding here states that he wishes the witness to state those things which he deems essential to be known.)

From these tanks it is led into the boilers by a hose. The boilers being charged, fire is applied until a pressure of a hundred and sixty to a hundred and seventy pounds, and sometimes higher, is attained. I ascertained this pressure by measurement of the safety-valve. The workmen regulate the degree of the fires by the pressure-gauge attached to the boiler. The materials are kept under this pressure for five hours, the fires are then withdrawn, the discharge-valve at the bottom of the boiler opened, and the contents blown out into a suitable vessel. The blowing-out requires from two to four minutes. The product is placed in cars with perforated bottoms, and washed with hot water, (the washings are saved, evaporated to dryness, and calcined in a reverberatory furnace. The result is a mixture of charcoal, carbonate of soda, with some caustic soda probably. This is bleached, and the soda may be again used. A certain portion is always lost dusing the operation.)

The material, after washing, is taken to the beating-engine—an
373 ordinary rag-beating-engine—as I understood, modified by having the points on the heating-cylinder blunt instead of sharp. I don't know how long it was in the beating-engine, but I was informed a short time. It is then pumped into a bleach-vat, and then submitted to the action of a bath of chloride of lime, containing 15 per cent. of the chloride to the dry pulp, or about 5 per cent. to the original amount of wood. The bleached pulp is now washed and submitted to a prolonged beating in the rag-engine. This prolonged beating is found to enable it to hold water, as it is termed, when passing over the wire of the paper-making machine. It is then made into paper by the usual process.

Q. 6. What would be the effect of using a less proportion of caustic soda?

A. The intercellular matter would not be wholly removed. The yield would be larger, but the material less adapted to paper-making.

Q. 7. In order to carry on the process properly, is it not necessary to know the quantities of soda proportionate to the quantity of material treated?

A. It is necessary: but when in doubt, from any cause, (as from greenness or dryness of wood,) it is always safe to use an excess.

Q. 8. The quantity set forth by you, to wit, 20 per cent. caustic soda to weight of wood, is the quantity requisite for wood in its average condition?

A. It is slightly in excess of the requisite quantity.

Q. 9. Was that not the usual proportion which you understood to be used at plaintiffs' works?

A. It was.

Q. 10. What would be the effect of reducing the time of boiling the wood from five hours down; and what would be the effect of increasing the time from five hours up, at the plaintiffs' works?

A. I did not see any boiling made there of less than five hours from the time of firing; but, from experiments on a small scale, I believe that by diminishing the time the chemical action would be incomplete. Some portions of the wood would be disintegrated, and other portions not. In boiling under pressure, there is no bubbling. It is more of a soaking action, and requires time. When a substance is boiled
374 in an open vessel, the agitation of the liquid moves the body, if a solid, in various directions, thus facilitating the action of the liquid upon it. This is not the case when boiling under pressure. An increase of time, provided there were no excess of alkali, would, I think, make no difference; but, if there were an excess of alkali, prolonged boiling would act on the cellulose, and the yield would be diminished.

Q. 11. What would be the effect of diminishing the pressure from 160 pounds; and what would be the effect of increasing it above 160 pounds?

A. Diminishing the pressure renders necessary a longer boiling; below 50 pounds, satisfactory chemical action would not take place. Increasing the pressure above 160 pounds would, I believe, shorten the process; but I do not say this from experiment or observation.

Q. 12. Would satisfactory results take place by boiling at a pressure of 50 pounds; and what do you mean by satisfactory results in your last answer?

A. By prolonged boiling, with an excess of alkali at 50 pounds pressure, a pulp may be obtained, but not of good quality; that is, the intercellular matter is not entirely removed. By satisfactory results, I mean obtaining a pulp, which might be made into paper without admixture. I speak, in this answer and in the last—in fact in all these answers—of the action of caustic alkali upon wood chips.

Q. 13. What would be the effect of reducing the pressure below 50 pounds, and increasing the quantity of alkali and time of boiling?

A. I made no experiments between atmospheric pressure and 50 pounds. My opinion is that, as we diminish the pressure, less of intercellular matter is removed.

Q. 14. Did you find, in your experiments from 160 pounds pressure down to 50 pounds, that, as you diminish the pressure, you had to increase the time and increase the quantity of alkali, and that the amount of intercellular matter removed diminished?

A. I did.

Q. 15. Is it not your opinion that boiling wood in caustic alkali for a prolonged time, at a temperature of 230°, would remove some of the intercellular matter?

375 A. I think that it would.

Q. 16. Is it not your opinion that, as the temperature is increased above 230°, that the amount of intercellular matter removed would be increased in proportion to the increase of temperature up to 376°, (the temperature equivalent to 160 pounds pressure?)

A. I think that it would. The intercellulose varies greatly in its resistance to chemical agents. That which incrusts the fibre proper is the most difficult of oxidization, and requires high temperatures.

Q. 17. Do you know at what temperature that which incrusts the fibre is removed?

A. It is removed at 160 pounds pressure, but at what lower I cannot state. I know it is removed at 160 pounds pressure, 370° temperature,

and I know it is not entirely removed at 50 pounds pressure, or 303° of temperature, but some of it is; but what intermediate point between these it is entirely removed, I cannot say; there probably is a point, but I cannot fix it.

Q. 18. What do you mean by the expression, it "requires high temperature to remove the intercellulose that incrusts the fibre proper," in your sixteenth answer? What temperature had you in your mind when you gave that answer?

A. About 300° Fahrenheit.

Q. 19. Why do you fix 300° Fahrenheit as the minimum at which that incrusting matter can be removed, instead of 280°?

A. In an experiment made at 313°, the incrust was not removed; and therefore, I state that the temperature must be above 300°.

Q. 20. Then you can fix no point between 373° and 306° of temperature, as the minimum point at which this incrust would be removed?

A. I cannot.

Q. 21. What effect on the weight of the product and upon its character as a pulp, has the presence of this intercellulose, which incrusts the fibre proper, referred to in your sixteenth answer?

A. It will increase the weight of the product and render the fibres less pliable.

Q. 22. Can you fix the minimum point of temperature at which
376 the product is thirty per cent. of the wood and when the fibres are flexible, thoroughly detached from each other, pliable, and capable of felting together?

A. The minimum point I cannot fix; but such product will be obtained at 155 pounds' pressure, corresponding to 384° of temperature. This is the lowest my own experiments fix.

Q. 23. Has pressure anything to do with the conversion of wood into pulp, except so far as it is necessary to preserve the liquid state under the increased heat?

A. It has not.

Q. 24. Are not heat and caustic alkali and water the only essential requisite in the conversion of wood into pure pulp or cellulose?

A. I presume that they are; but we have made no experiments on the subject.

Q. 25. Can you not, by increasing the strength of your solution of caustic alkali, obtain a heat of 360°, the solution remaining liquid without pressure?

A. Yes.

Q. 26. You have defined, in answer twelve in-chief, the necessary fibres requsite for the manufacture of paper as those fibres which are flexible, thoroughly detached from each other, pliable, and capable of felting or matting in the production of such fibres, as the features of reissues 1448, 1449?

A. Yes. I understand the nature of the invention described in 1448 and 1449 was the production of such fibres.

Q. 27. With a sufficient amount of caustic alkali, does not the amount of intercellulose removed and the purity of the pulp produced increase with the increase of temperature from 212° Fahrenheit upwards?

A. In my judgment, the amount of intercellulose removed and the purity of pulp produced does increase with an increase of temperature from 212° Fahrenheit upwards; but I do not know in what proportion it increases correspondingly with the increase of temperature. I made no experiments above 390° Fahrenheit; and up to that point the amount of intercellulose removed did increase with the increase of temperature.

377 Q. 28. Is there not intercellulose in unbleached linen; and when unbleached linen or unbleached linen-rags are boiled in caustic alkali, under pressure, preparatory to being bleached or made into paper, is not a portion of this intercellulose removed?

A. There is intercellulose present, and a portion is removed by the preliminary boiling in caustic alkali.

Q. 29. Prior to 1853, were there not two chemical processes laid down in the books for obtaining cellulose from wood—one by boiling wood in caustic alkali, then re-acting by chlorine, and again re-acting by caustic alkali; and another chemical process, described by boiling the wood with a solution of caustic alkali alone, the temperature being increased in the latter case to a high degree by the increasing density of the solution?

A. There were. Dumas, in his "Traité du Chimie," Paris, 143, (vol. 6, p. 17,) describes these two processes. Regnault's Chemistry, (American edition, 1852, Philadelphia,) describes the method of obtaining cellulose by the alternate action of hot caustic alkali and chlorine.

Q. 30. Does not Dumas draw the distinction between coniferous or resinous woods and other woods, so far that chlorine is necessary with the former, and may be dispensed with with the latter?

A. He does at the reference last named.

Q. 31. Could not a temperature considerably above 300° be attained by boiling woods continuously in solution of caustic alkali in an open vessel; and how high a temperature could be obtained by boiling a solution of caustic alkali not under pressure?

A. Yes. Storer, in his Dictionary of Solubilities, (p. 454,) says that the saturated aqueous solution of caustic soda boils at 216° Cant., 420° Fah. (T. Griffith, Quar. J. of Scien., 1825, v. 18, p. 91.)

Dalton's New System, (part 2, p. 496,) an aqueous solution of caustic soda.

Deg. Beaumé.	Sp. gr.	Contains per ct. of NaO.	Boils at. Cent.	Fah.
76	2.00	77.8	Red heat.	
70	1.85	63.6	315.56	600
64	1.72	53.8	204.44	400
59	1.63	46.6	148.89	300
378 55	1.56	41.2	137.78	280
51	1.50	36.8	129.44	265
49	1.47	34	123.89	255
47	1.44	31	120	248
44	1.40	29	116.66	242
40	1.36	26	112.78	235
37	1.32	23	108.89	228
34	1.29	19	106.66	224
29	1.23	16	104.44	220
23	1.18	13	102.78	217
17	1.12	9	101.11	214
9	1.06	4.7	100.56	213

Dalton remarks upon the table that "it will be found moderately accurate; but I could not give it the attention it deserves." I have converted the centigrade degrees in Storer to Fahrenheit.

Q. 32. In treating wood, does not the invention in the re-issued patents Nos. 1448 and 1449, relying upon a single direct action of the caustic alkali alone, require a certain percentage of alkali to the wood, and

a certain minimum temperature to insure that result which would be obtained by the combined successive processes mentioned above; and *is* not the quantity of alkali required and the temperature necessary in the two cases entirely different?

A. A certain percentage of caustic alkali to the wood and a certain minimum temperature are requisite to carry out the invention set forth in 1448 and 1449, and these are different from the quantity of alkali and temperature required in the process of treating wood successively with alkali, chlorine, and alkali again. The percentage of alkali to the wood required in the successive stage—alkali and hypochlorite process—is much less. To the extent that the hypochlorites are used, the alkali required is less. The product obtained by the process of boiling wood in caustic alkali alone at the proper temperature and strength, differs also in some of its physical properties from the product obtained by the successive treatment with alkali and chlorine, according to my experiments, and I presume there would be the same difference
379 in the physical appearance of the product obtained by the successive action of alkali and hypochlorites.

Q. 33. In converting wood into pulp by boiling it in caustic alkali under pressure, when the temperature employed is sufficient to remove a large part of the intercellulose, but below that requisite to remove the incrusting matter referred to by you in your 17th answer on cross-examination, would not that final incrusting matter be removed by a disintegrating action of the chlorine taking place at the same time that the bleaching of the pulp took place, and consuming a certain portion of the chlorine by that disintegrating action?

A. The final incrust would probably be in great part removed by the chlorine, but not entirely. The product would not be of as good quality as that in which all the intercellulose had been removed by the alkaline treatment at a high temperature preliminary to a simple bleaching process.

Q. 34. If wood were treated with caustic alkali under pressure, at a temperature below 300°, and then bleached with chlorine, could not a fair result of white paper be obtained, although inferior in quality to that which would be obtained if a preliminary treatment, under a higher temperature with caustic alkali, had taken place.

A. Yes.

Q. 35. In all cases, must not the pulp obtained from wood be bleached by chlorine, or equivalent bleaching-agent, before it can be made into white paper?

A. Yes.

Q. 37. Can you draw any marked line of temperature below 360° as a point for the alkaline treatment at which this subsequent disintegration by chlorine would not be requisite in the converting of wood into white paper.

A. I cannot.

Q. 38. Can you name any specific chemical property, so far as disintegrating wood is concerned, which a caustic-alkaline solution, at a temperature of 300° Fahrenheit possesses, which is not possessed by a caustic alkaline solution at a temperature, say, 290° Fahrenheit?

A. Not having made any experiments below 306° Fahrenheit
380 temperature, I cannot answer this question of my own knowledge; but I do not presume that there is any specific difference between the action that takes place at those two temperatures.

Q. 40. How do you come to select 160 pounds pressure, or 380° Fahrenheit temperature, as the lowest temperature at which you experi-

mented with success in removing the incrusting matter and making a pulp which could be bleached into white paper without a chlorine disintegration being required?

A. Because that was the temperature which I was informed at the plaintiff's works was the usual minimum temperature used at the American Wood-Pulp Company's works, at Manayunk. The gauges used were blind, so that no stranger could tell the pressure from them; but I satisfied myself that such was the minimum pressure used by them.

Q. 41. Does not the French patent of Montgolfier Fréres, of 1838, defendants' Exhibit No. 11, describe a process of treating wood, by boiling in a caustic alkali, under pressure, as a preparatory process for making pulp for the manufacture of paper from such wood?

A. It does.

Q. 42. Do Montgolfier Fréres fix limits to the pressures under which they boil vegetable matters in caustic alkali?

A. They do not.

Q. 43. After the boiling in caustic alkali, under pressure, do not Montgolfier Fréres provide for bleaching the pulp?

A. Yes.

Q. 44. Would not a temperature approximating 300° Fahrenheit be attained by boiling vegetable substances in a solution of caustic soap, according to Legoux's description in his French patent of 1839?

A. It would be within three or four degrees of that temperature.

Q. 45. Suppose you make a solution containing ten per cent. of its volume of soda-ash, and render it caustic by five per cent. of the solution of lime, what would be the strength of the caustic alkaline solution obtained?

A. It would be about 9° Beaumé, or 12° Twaddell.

Q. 46. Do not Dumas, Payen, and Labouillaye, and the writers
381 on general chemistry, or on chemistry as applied to manufactures, so far as you have referred to them, treat "sel de soude" as meaning common soda-ash?

A. Yes; while in pharmaceutical works "sel de soude" is often referred to as crystallized carbonate of soda.

Q. 47. What would be the temperature of a solution of caustic soda of 9° Beaumé, under a pressure of 44½ to 45 pounds?

A. It would be about 297° Fahrenheit.

Q. 48. Does not Gros, in his French patent, 1847, Exhibit 19, describe the treatment of wood with an alkaline solution, rendered caustic under pressure, as a preparatory process for making pulp for the manufacture of paper?

A. He does.

Q. 49. Would not the pressure Gros names give a temperature of near 300°?

A. It is within three degrees of it, with a caustic alkaline solution of 5° Beaumé, and wood. With a caustic alkaline solution of 12° Beaume, and wood, it would be within a degree of 300°.

Q. 50. After the pulp had been thus produced by Gros' process, does he not say it is to be bleached with chlorine or chloride of lime?

A. He does.

Q. 51. Does not Doubouchet, in his French patent, September 28, 1840, (Defendants' Exhibit 16,) describe a process of treating vegetable substances by boiling in caustic alkali, under pressure, as a preparatory process for making pulp for the manufacture of paper?

A. He does.

Q. 52. How high a temperature does he call for?

A. About 280°.

Q. 53. By Doubouchet's process, after the pulp was made by boiling in alkali, was it not submitted to the bleaching process and then made into white paper?

A. It was.

Q. 54. Does not Breuil, in his patent of February 12, 1846, describe a process of boiling vegetable substances in an alkaline solution, rendered very little caustic, under pressure, as a preparatory process for making pulp for the manufacture of paper from such vegetable substance?

A. He does.

382 Q. 55. Does not Lemuel Wright, in his English patent of 1843, describe a process of boiling vegetable substances in caustic alkali, under pressure, as a preparatory process for the making of pulp for the manufacture of paper from such vegetable substances?

A. He does.

Q. 56. Does Wright, in specific terms, limit his pressure?

A. He does not.

Q. 57. After the pulp has been produced by the boiling in caustic alkali, does not Wright call for the bleaching of it by hypochlorite of lime, or chloride of lime, as it is commonly called, to make white paper?

A. He does.

Q. 58. What would be the temperature under which the straw is boiled in strong lye, under pressure, according to the description contained in the Central Blatte, of September 27, 1852, (Exhibit 25,) and in the Industrie Austellung, of 1851, (Exhibit 26)?

A. It would be somewhat above 341° Fahrenheit.

Q. 59. Does not the French patent of Coupier and Mellier, of May 7, 1851, (Exhibit 46,) describe a process of treating wood, or other vegetable substances, by boiling in caustic alkali, under pressure, as a preparatory process for making pulp for the manufacture of paper from such wood or other vegetable substances?

A. It does.

Q. 60. After being so treated, is not the pulp bleached by the action of the hypochlorite of lime or alumina, so as to make white paper?

A. It is.

Q. 61. Do you consider the mode of making pulp from wood or other vegetable substances, by boiling them in caustic alkali, under pressure, at a temperature of 230°, with a strength of 8° to 10° Beaumé, (in 11° to 14°, English hydrometer,) and then treating with hypochlorites, as described in Coupier and Mellier's patent, May 17, 1831, to be a substantially different invention from that contained in re-issues 1448 and 1449?

A. I do consider it to be a substantially different invention.

383 Q. 62. What is the difference between the chemical action which takes place in the invention contained in Coupier and Mellier's patent, of May 7th, 1851, and in the invention described in re-issues 1448 and 1449?

A. In the invention described in the re-issues 1448 and 1449 the intercellulose is removed by the single action of caustic alkali at the high temperature named; at the lower temperature mentioned by Coupier and Mellier, for boiling in caustic alkali, a portion of the intercellulose only would be removed by such boiling, and the remainder of the intercellulose would be oxidized by the hypochlorites, so as to be subsequently removed.

Q. 63. Do you consider the invention described in re-issues 1448 and

1449 to be substantially different from the process described by Regnault? (p. 446, Exhibit No. 37,) and state wherein chemically it is a substantially different invention.

A. I do consider the invention described in re-issues 1448 and 1449 to be substantially different from the process laid down by Regnault. In the process described in the re-issues 1448 and 1449, the intercellulose is removed at a single operation, by boiling in caustic alkali at the temperature named. In Regnault's process a portion of the intercellulose is removed by a solution of an alkali at a temperature not necessarily above 212°, and the remainder by a treatment with chlorine or hypochlorites of lime, followed by a third treatment with alkaline solutions and a dilute hydrochloric acid; afterwards washed with alcohol and ether to remove any fatty matter. This process, Regnault remarks, will also destroy a portion of the cellular tissue.

Q. 64. In the process of converting wood into cellulose by the successive action of caustic alkali; 2d, of chlorine or hypochlorous acid; 3d, alkali; and 4th, of hypochlorus acid, is boiling under pressure in the first stage consistent with the other stage of the process?

A. Boiling under pressure is consistent, if the pressure is less than that required to remove all the cellulose.

Q. 67. Does the process of boiling wood in caustic alkali, as pursued at defendants' works, and as understood by you, fall within the claim of the patent of M. A. C. Mellier, of May 26, 1857?

A. The claim of the Mellier patent refers to straw alone.

384 Q. 68. Do not Keen's boilers, of patent of September 13, 1859, and the boiler of Lemuel Wright, of March 27, 1847, agree in both being vertical cylindrical boilers and both having discharge valves or cocks at the bottom, and that in both vegetable matters are digested with caustic alkali under pressure, and that the matter, after being digested in both, is discharged by steam-pressure through the lower cock?

A. Yes.

Q. 73. What force do you give to the word "near," used in connection with 300°, in re-issue 1449?

A. I should say about 295°.

Q. 74. Have you any special reason, based on chemical actions, for fixing that limit to word "near?"

A. I have not; it is a mere opinion.

Q. 76. In the patent of M. A. C. Mellier, dated May 26th, 1857—1st, is it not specifically stated that the boiling is to be regulated by a pressure-gauge; 2d, that the pressure should be maintained in the inside of the boiler of from 70 to eighty pounds; 3d, that the proper quantity of alkali to be used is 70 gallons of a solution of caustic alkali of 1.013 to 1.020 specific gravity to each cwt. of straw; 4th, that this heat and pressure should be kept up for about three hours; and are not these important instructions to enable a paper-maker to carry out practically the process without experiment?

A. It is so stated. These instructions are important to enable a paper-maker to carry out the invention without experiment.

Q. 77. You have stated that woods of average condition require about 20 pounds of caustic alkali to the 100 pounds of wood, and that a pressure of about 160 pounds gives the required temperature to insure good pulp, and that about five hours is required to complete the process, as the invection is carried out practically at plaintiffs' works at present. Please point out to me, in the specification, of re-issue 1449, how a paper-maker, reading the same, without further experiment on his part,

could arrive at any knowledge of the quantity of alkali to use, and the pressure to be employed at the time of operation, so as to pro-
385 duce such pulp as you have described in your 12th answer, from any wood or vegetable substance whatever.

A. The specification does not give the proportionate quantity of alkali. A paper-maker could not ascertain the facts referred to in the question, from the specification, without experiment. The specification expressly states that the strength of alkali, the temperature and the time must vary with the material under treatment.

Q. 78. What experiment would a paper-maker be required to make in order to ascertain what quantity of alkali to use, say with deal or with poplar wood?

A. He would weigh a quantity of wood, a measured quantity of solution of alkali of known strength, say 12° Beaumé, and digest the same at a pressure of say 150 pounds, for an observed time, say two hours, then open and take out specimens, and examine them. If pulping had not been completely accomplished, he could test the caustic alkali, and, if still caustic, he would be satisfied that the effect was not in having used too small a quantity of alkali. A second trial, at a higher temperature and prolonged time, would probably yield the desired result. No mere directon, verbal or written, will enable a man successfully to carry out chemical manufacturing operations without some experience.

Q. 79. Suppose wood to be pulped by boiling in caustic alkali first, and then treated with chlorine to complete the operation, would there be any substantial difference whether the first boiling took place at a pressure due to a temperature of 300°, or at a pressure due to a temperature of 280° Fah.? If so, what is the substantial difference in the chemical operation?

A. As the temperature is reduced, the action of the alkali is diminished, and this diminished action would require a proportionate increase of the action of the chlorine or its compounds, to complete the result.

Q. 80. Suppose wood be pulped by boiling in caustic alkali first, and then treated with chlorine to complete the operation, would there be any substantial difference whether the first boiling took place at a pressure due to a temeerature of 280°, or at a pressure due to a temperature of 260° Fahrenheit?

A. I would make the same answer as to the last.

386 Q. 81. Would this same rule hold good up to 360° Fah., or that point of temperature, whatever it may be, where boiling in caustic alkali alone would remove all the intercellulose and make pure pulp?

A. I believe so.

Q. 82. So far as your own knowledge or experiments have gone, you could not find any lower point than 360° as the one at which chlorine could be entirely dispensed with as a pulping agent with wood?

A. No, I could not; but my experiments were limited in number. I believe there is a point below that with some woods, because different vegetable matters vary in their resistance to chemical agents.

Gross-examined by Mr. Harding:

Q. 83. Do I understand you to intend to convey the impression by your examination-in-chief to-day, that in working under the re-issued patent of Ladd and Keen, of 1863, the use of a rag-engine would in no way aid or contribute materially to the production of the pulp?

A. I do so intend. The use of the rag-engine is necessary after the pulp is bleached, before it can be made into paper.

Q. 84. Do you not believe that some mechanical means of crushing or separating the wood into shavings or chips, or shreds, is important before or during the time of its being treated by chemicals, to make pulp; or could the pulp be as well made by submitting the logs to chemical treatment?

A. The sub-division of the wood is important, as it facilitates the action of the alkali and shortens the time of the process.

Q. 85. Have you ever treated wood, or seen it treated chemically, without some previous disintegration, such as chipping, crushing, or grinding?

A. I have not.

Q. 86. Is the specimen, Exhibit No. 24, which you now produce, a fair specimen of the unbleached pulp which you understand to be produced by the Lad' and Keen re-issued patent' 1448 and 1449, as the result of the first stage of treatment?

387 A. It is.

Q. 87. In giving your answers as to the Watt and Burgess invention, patented in said re-issue, have you considered it to be a process which produces a result such as Exhibit 24, by a single treatment in caustic alkali under pressure?

A. I have.

Q. 88. Under what pressure and corresponding temperature was that result, Exhibit 24, produced?

A. I did not notice the pressure on my visit to the works that day. I suppose it was produced at 150 pounds pressure, corresponding to a temperature 378 degs. Fahrenheit.

Q. 89. Have you any practical knowledge or experience on the subject of paper-making, other than that derived from your visits to the plaintiffs' works; and if so, what?

A. I have no other, except in so far as in my experiments in making pulps, as here testified to.

Q. 90. How many visits have you made to the plaintiffs' works prior to giving your first testimony-in-chief, and how long a time did you spend there?

A. I think five visits. I generally spent half a day, or nearly that; on one occasion, nearly the whole day.

Q. 91. When you say a certain mechanical treatment of fibres is necessary to enable them to felt in pulp of all kinds, do you state what was stated to you by others, or do you state the result of your own experiments; and if so, what experiments?

A. I state on information received at the works, from Mr. Nixon. I think also from Mr. Burgess. I do not now remember any others.

Q. 92. To what mechanical treatment did you submit the broom, referred to in your experiment, preparatory to boiling it in caustic alkali?

A. I took off the bark and cut the wood into short pieces. That was all the mechanical treatment it underwent. The pieces were about an inch long.

Q. 93. In your experiment, as detailed in your sixty-third answer in your examination-in-chief to-day, do you consider that you worked under the Watt and Burgess patent, as re-issued 1448 and 1449?

388 A. I do, inasmuch as the temperature was about 300° and a solution of caustic alkali of a strength of 9 Baumé was employed.

Q. 94. What was your object in making that experiment? Why did

you select 2 degrees Baumè as the density of your solution, and forty-five pounds as your pressure?

A. From my cross-examination, I presumed that it would be assumed that the patent of Sieur Gros called for such a strength of alkali, and such a pressure, and I wished to see if allowing such assumption, broom could be pumped.

Q. 95. Do you know what was the age of the broom that you used?

A. I do not.

Q. 96. Have you ever seen broom grown before?

A. I have seen broom growing, but I did not see this growing. I saw it growing several years ago in considerable quantity in what is now Fairmount park.

Q. 97. What was the temperature attained in that experiment made by you with the broom, and of which Exhibit 25 is the result.

A. About 300° Fahrenheit.

Q. 98. If in making that experiment you consider you worked under the Watt and Burgess patent, re-issue 1449, do you or do you not consider Exhibit 25 as a result produced by the Watt and Burgess process?

(Mr. Wallace objects to the question.)

A. I do not, for this reason: in acting upon a wood of the tough character of broom for the purpose of disintegration, under the Watt and Burgess patent, I certainly should have used a higher pressure and corresponding temperature, being satisfied from previous experiments, that a satisfactory result could not be obtained, in acting upon such material at a pressure of about forty-five pounds and temperature 300° Fahrenheit, and did not make the experiment under the Watt and Burgess patent.

Q. 99. What temperature would you have used in treating broom, if you had intended to work under the Watt and Burgess patent, re-issue No. 1448 and 1449?

A. About 380° temperature, corresponding nearly to a pressure of one *one* hundred and sixty pounds.

389 Q. 100. In making the experiment, Exhibit B. H. R., No. 7, boiling wood in 318° Fahrenheit, in caustic alkali, do you consider you worked under the Watt and Burgess patent, as re-issued Nos. 1448 and 1449?

(Question objected to.)

A. I do.

Q. 101. Is the result shown in Exhibit 7 a specimen of the result of the Watt and Burgess patent, as re-issued Nos. 1448 and 1449 or not?

A. It is not, for the reasons given in my last answer in reference to Exhibit 40. If I had desired to make paper-pulp from the wood, such as I was experimenting on, I would have used higher temperature and corresponding pressure. The experiment was not made for the purpose of producing pulp for the manufacture of paper, but to compare the effects of caustic alkali upon wood of different pressures and temperatures.

Q. 102. What wood do you employ in that experiment, Exhibit No. 7; and how high a temperature would you have employed, had you desired to work under the re-issue of the Watt and Burgess patent Nos. 1448 and 1449?

(Question objected to.)

A. I employed poplar wood; and if I had desired to work under the re-issue of the Watt and Burgess patent Nos. 1448 and 1449, I should have used a pressure of 160 pounds, corresponding to a temperature of about 376° Fahrenheit.

Q. 103. Can you name me any specific wood with which you would have used a temperature of 300° Fahrenheit, if you had desired to work under the Watt and Burgess patent, as re-issued Nos. 1448 and 1449, and a corresponding pressure?

(Question objected to.)

A. I have experimented with but four varieties of wood commonly so called pine, poplar, bamboo, and broom. I have succeeded in disintegrating bamboo at that temperature, but should not practically employ it, for the process is shortened and the product improved by using the higher temperature. I cannot name any specific wood with which I would use the above temperature.

390 Q. 104. Can you quote any part of the Watt and Burgess patent, as re-issued Nos. 1448 and 1449, which conveys the information that a temperature of 360° Fahrenheit and the corresponding pressure is the proper one for treating wood of any kind, or a temperature of 300° Fahrenheit is too low a temperature for certain woods?

(Question objected to.)

A. I cannot make such quotation.

Q. 105. Are there not vegetable materials which, in your judgment, would be completely pulped at a pressure due to 212° Fahrenheit in caustic alkali?

A. Yes.

Q. 106. Please furnish me the equivalent of Beaumé's hydrometer and the English hydrometer of from 1 to 25.

A. *Comparison of the hydrometers of Twaddell and Beaumé.*

B.	Far.	Far.	B.
1° =	0.14°	1	—
2 =	.63	2	1½
3 =	4	3	2
4 =	5.5	4	3
5 =	7	5	4
6 =	8	6	4½
7 =	9.6	7	5
8 =	11	8	6
9 =	12.6	9	6½
10 =	14	10	7¼
11 =	15.6	11	8
12 =	17	12	8½
13 =	19	13	9¼
14 =	20	14	10
15 =	21.8	15	10½
16 =	23.6	16	11¼
17 =	25.2	17	17
18 =	26.1	18	12½
19 =	28.1	19	13
20 =	30.4	20	10

Q. 107. What is the pressure due to a temperature of 500° Fahrenheit?

391 A. About 662 pounds, total internal pressure equal to 647 pounds pressure of the steam-guage.

Q. 108. In working at a temperature of 360° as a practical temperature for securing the result of Watt and Burgess patent, re-issue Nos. 1448 and 1449, with the ordinary woods, such as pine, poplar, fir, do you arrive at that temperature as the result of experiments made by you or from any specific statement of temperature made in the re-issued patent of Watt and Burgess, Nos. 1448 and 1449; and if from any specific statement of temperature therein, quote that statement.

(Question objected to.)

A. I arrive at that temperature from my experiments and not from any statement in Watt and Burgess patent, as re-issued Nos. 1448 and 1449.

Q. 109. Do you consider time an important element in treating wood with caustic alkali, under pressure, to make pulp?

A. I do. As you diminish the pressure to a certain point you can make up for it by lengthening the time of boiling. Again, when the wood is in large chips a longer time is requisite than when it is broken in small pieces. Less time also is required in a small than a large boiler, when treating a small quantity.

Q. 110. Do you consider the quantity of alkali to the weight of wood to be important?

A. Yes, I do.

Q. 111. Can you quote anything from the Watt and Burgess patent as re-issued No. 1448 and 1449, which indicates the proportion of alkali to the weight of wood, or which indicates the time of the operation?

A. There is no definite indication of the per cent of alkali to the weight of wood. If, however, a solution of caustic alkali of 17 Twaddell, sufficient to cover the wood, be employed, it would give a slight excess of alkali under ordinary circumstances. There is a direction as to time, I believe, viz., from four to twelve hours.

Q. 112. Will the same amount of water, 8½ Beaumé, answer with resinous woods?

A. I should suppose that it would. I cannot say of my
392 own knowledge. I never made any experiment or observation on this point.

Q. 113. Can you fix the minimum strength of the alkali that could be used, if the water just covered the wood, to produce pulps with the ordinary woods?

A. I cannot.

Q. 114. Does the patent contain any indication of the quantity of the solution of a given strength to be used?

A. It does not.

Q. 115. What is the lowest proportion of alkali to the wood, treated by weight, that you have succeeded in making pulp of in your experiments?

(Objected to.)

A. Eighteen per cent. of the wood treated, by weight, an imperfect pulp, but one that would bleach, was made with 14.4 per cent. of caustic alkali.

Dr. RAND recalled by Mr. Wallace:

Q. 1. The intercellulose being removed by oxidization in this process of pulping wood, is there not an equivalent of alkali that is necessary to the perfection of the operation without reference to particular temperatures or strength?

A. A certain percentage of alkali is requisite. I believe that the intercellulose matter is converted into organic acids, ulmic, lumic, and *give* acids. These form a definite chemical compound with the soda. When the alkali is deficient in quantity, as in experiments 4 and 5 of the table, all the intercellulose is not removed.

Q. 2. That being the state of the case, would not the commercial success of the process render it necessary or desirable for the manufacture of pulp to approach as near as possible to the exact equivalent in prac-

tice, and would not the profit of the manufacture greatly depend upon that?

A. Yes; a slight excess would do no harm.

B. HOWARD RAND.

Sworn and subscribed this 10th day of June, A. D. 1867.

HENRY PHILLIPS, J'R,
Commissioner.

CHARLES M. CRESSON, M. D., a witness for the complainants, being produced and duly affirmed according to law, doth depose and say:

393 Q. 1. What is your name, age, residence, and occupation?

A. Charles M. Cresson; age, 39; residence, No. 210 N. 17th street, Philadelphia; am a civil engineer and chemist.

Q. 2. Have you made experiments or assisted in the making of experiments on the subject of temperatures and pressures in reference to the various pressures corresponding to the various temperatures in boiling distilled water alone and vegetable substances in caustic alkaline solutions of various strengths? Have you made any table or assisted in making any such table of such experiments and results? Is the table annexed to the testimony of Dr. Rand, marked Exhibit A, a copy of the table?

A. I have made and assisted at the making of such experiments and tables, and that marked Exhibit A is a correct copy of the results obtained.

Q. 3. Please state how these experiments were made, and whether the results as stated are correct.

A. They were made in a small boiler adapted for use under very high pressures. The temperatures were obtained by means of a the'mometer placed within a small tube passing through the shell of the boiler, and extending some distance below the surface of the contained liquid. In addition to the usual verifications of the correctness of the the'mometrical scale, the temperatures obtained by Sewall with distilled water under various pressures were recorded, and are placed alongside of the results in the table, Exhibit A. The pressures were obtained by observation of a verified pressure-gauge of the form patented by Justice, and I believe the results stated in the table, Exhibit A, to be practically correct.

Cross-examination declined by Mr. Harding.

CHARLES M. CRESSON.

Affirmed to and subscribed this 10th day of June, 1867, before me.

HENRY PHILLIPS, J'R,
Commissioner.

Sundry vials marked, numbered 1 to 23, produced, and marked by examinee with his initials, H. P., j'r, and date June 10th, 1867.

Exhibit B, of Dr. Rand's testimony.—Table of experiments upon pulping wood.

No. of experiment.	Weight of wood.	ALKALI. Caustic alkali.	Water for dilution.	Grains caustic soda.	Specific grav. Beaumé.	Per ct. caustic alk. to wood.	Per ct. caustic alkali to pulp.	Pr. ct. of caust. alk. to proper pr. ct. of pulp.	Sp. gr. resultant liquid.	HEAT. Tem. in boil'r Fahrenheit.	Corresponding pres're in lbs.	H'rs und'r boil.	PROD'CT. Weight of pulp.	Per ct. of pulp to wood.	Experiments, where made, and when, 1866.	GENERAL REMARKS AND RESULTS OF MICROSCOPIC OBSERVATIONS.	
1	5, 250 grs.	36 f ℥	.....	945	11½	18	60.	60.	21°	384°	165	1	1, 577 grs.	30.	June 13, '66, at Am. Wood-Paper Co.'s Works, Manay'nk.	Normal.	Green wood fresh from chipping-engine. Fibres perfectly separated; is entirely and immediately soluble in sulphuric acid. Colorless solution; pure cellulose. Bleached.
3	5, 250 grs.	36 f ℥	36 f ℥	945	5½	18	47.9	51. 1	.....	380°	165	1	1, 971 grs.	37. 5	June 20, '66, at No. 417 Walnut street; wood dry; chipped for boiler June 13, 1866.	Alkali diluted with equal bulk of water.	Fibres separated; soluble in sulphuric acid. Trace of color. Solution colorless. Bleached.
4	5, 250 grs.	f ℥ f ℥ ℥ ℳ 27 6 24	32 f ℥	756	5	14. 4	35. 2	41.	8°	376°	160	1	2, 145 grs.	40. 8	June 21, at No. 417 Walnut st.	Twenty per cent. of alkali off.	Fibres separated, but not entirely clear of encrusting matter. In sulphuric acid, light-brown solution. Bleached.
5	5, 250 grs.	18 f ℥	54 f ℥	472	2. 8	9.	17. 5	25. 5	.....	378°	165	1	2, 695 grs.	51. 3	June 21st, at No. 417 Walnut st.	Fifty per cent. of alkali off.	Chippy; fibres adherent; soluble in sulphuric acid; almost black. Would not bleach.
6	5, 250 grs.	36 f ℥	36 f ℥	945	5½	18.	29. 7	51. 1	7°	313°	60	1	3, 181 grs.	60. 6	June 21st, at No. 417 Walnut st.	Normal amount of alkali, but with reduced temperature.	Chippy; fibres not separated; apparently unaffected, except removal of dried sap. Solution of sulphuric acid black. Would not bleach.
7	5, 250 grs.	36 f ℥	36 f ℥	945	5¼	18.	33. 2	51. 1	8°	313°	60	2	2, 840 grs.	54.	June 22d, at No. 417 Walnut st.	Normal amount of alkali, with temperature reduced. Double time.	Chippy; similar in appearance to No. 6 and 11. Sulphuric acid blackens. Would not bleach.
10	5, 250 grs.	f ℥ f ℥ ℳ 25 1 26	f ℥ f ℥ ℳ 46 6 24	662	3½	12. 6	28. 2	35. 82	6°	379°	165	2	2, 345 grs.	44. 6	June 25th, at No. 417 Walnut st.	Thirty per cent. of alkali off. Double time.	Partially pulped, but chippy; resists sulphuric acid strongly; dark-brown solution. Bleached.

Exhibit B, of Dr. Rand's testimony.—Continued.

No. of experiment.	Weight of wood.	ALKALI.								HEAT.			PROD'CT.		Experiments, where made and when, 1866.	GENERAL REMARKS AND RESULTS OF MICROSCOPIC OBSERVATIONS.	
		Caustic alkali.	Water for dilution.	Grains caustic soda.	Specific grav. Beaumé.	Per ct. caustic alk. to wood.	Per ct. caustic alkali to pulp.	Pr. ct. of caust. alk. to proper pr. ct. of pulp.	Sp. gr. resultant liquid.	Tem. in boil'r Fahrenheit.	Corresponding pres're in lbs.	H'rs und'r boil.	Weight of pulp.	Per ct. of pulp to wood.			
11	5,250 grs.	72 f ℥ 3	.....	1,890	11½	36.	72.2	102.2	12°	316°	60	1	2,617 grs.	49.8	June 25th, at No. 417 Walnut st.	Temperature off. Double alkali.	Similar in appearance to No. 6; sulphuric acid blackens. Would not bleach.
12	5,250 grs.	36 f ℥ 3	.....	945	11½	18.	51.3	51.1	24°	384°	165	1	1,840 grs.	35.	June 27th, at No. 417 Walnut st.	Normal solution and temperature, but with dry wood.	Fibres perfectly separated; is entirely and immediately soluble in sulphuric acid. Colorless solution. Pure cellulose. Bleached.
13	5,250 grs.	36 f ℥ 3	36 f ℥ 3	945	5½	18.	49.	51.1	8°	384°	165	2	1,930 grs.	36.7	June 28th, at No. 417 Walnut st.	Alkali diluted, but with dry wood.	Fibres separated; soluble in sulphuric acid. Colorless solution Pure cellulose. Bleached.
22	1,312 grs.	36 f ℥ 3	.....	945	11½	72.	192.4	204.4	.....	311°	55	7	491 grs.	37.4	Sept. 4, '66, at No. 417 Walnut st.	Four times normal alkali. Temperature off. Soaked in alk. 35 hours. Boiled 7 times as long as Nos. 1, 3, 12.	Structure broken up, but fibres coated with encrust and adhering in bundles; not very flexible; dissolves in sulphuric acid, but makes a very brown solution. Very much resembles No. 4.
23	1,312 grs.	9 f ℥ 3	9 f ℥ 3	236	5½	18.	36.9	51.1	.....	303°	50	16	640 grs.	48.7	Sept. 5, at No. 417 Walnut st.	Normal alkali; temperature off; soaked in alkali 98 hours; boiled 16 times as long as Nos. 1, 3, 12.	Structure broken up, but fibres coated with encrust; dissolves in sulphuric acid, but makes a brown solution.

395 EXHIBIT H. M. P., A.

Exhibit A, of Dr. Rand's testimony.—Temperatures and pressures.

	DISTILLED WATER.		SOLUTION OF CAUSTIC ALKALI AND INTERCELLULAR TISSUES. (RAND & CRESSON, 1866.)		
Pressure—lbs.	Sewell. 1852.	Rand & Cresson. 1866.	2° Beaumé.	5° Beaumé.	12° Beaumé.
30	276.4	276.	276.5	277.75	280.
32	279.2	278.5	279.	280.	284.
34	281.6	281.	282.	283.	286.5
36	284.4	283.	284.5	286.	289.
38	286.9	286.	287.25	288.	292
40	289.3	288.25	290.	291.5	294.
42	291.7	291.5	292.	293.75	296.
44	294.2	293.75	294.75	296.25	299.
46	296.9	296.	297.	298.	302.
48	299.2	298.	299.	301.	304.
50	301.3	300.	301.50	302.75	306.
52	303.4	303.	303.75	304.75	308.
54	355.4	304.5	305.25	307.	310.
56	307.4	306.75	307.	309.	312.
58	309.3	308.5	309.	311.	314.
60	311.2	310.5	311.	313.	316.
62	313.1	312.25	312.5	314.75	318.
64	314.9	314.25	314.25	316.25	.....
66	316.7	316.	316.25	318.	.....
68	318.4	317.	318.	320.	.....
70	320.1	319.	320.	321.50	326.
72	321.8	320.50	321.	323.	.....
74	323.5	322.+	322.75	324.	.....
76	325.1	324.	324.50	326.	.....
78	326.7	325.50	326.+	327.50	.....
80	328.2	327.	327.75	329.	337.
82	329.8	328.	328.75	330.25	.....
84	331.3	330.	330.+	332.	.....
86	332.9	331.50	331.75	333.25	.....
88	.....	332.75	333.+	335.25	.....
90	336.5	334.	334.25	336.25	343.
92	.....	335.	336.	337.50	.....
94	.....	336.50	337.	339.	.....
96	340.	338.	338.25	340.25	.....
98	.....	339.	339.75	341.50	.....
100	342.5	340.50	341.	343.	349.
110	348.9	346.50	347.	.....	354.
120	355.	352.	353.	.....	363.
130	360.6	357.5	358.	.....	368.
140	366.	363.25	364.	.....	373.
150	371.1	368.25	369.	.....	378.
160	376.	372.75	373.	.....	382.
165	378.4	375.	377.	.....	384.
170	380.6	377.50	380.	.....	385.50
180	385.1	382.	384.	.....	390.
190	389.3	386.	388.	.....	394.
200	393.4	390.	392.	.....	398.

396 Circuit court of the United States for the eastern district of New York.

THE AMERICAN WOOD-PAPER COMPANY
vs.
THE FIBRE-DISINTEGRATING COMPANY. } In equity.

Testimony taken June 5th 1867, *before Charles W. Newton, esq., examiner.*

LEMUEL WELLMAN WRIGHT, being duly sworn deposeth and saith

Q. 1. What is your name, age, residence, and occupation?

A. Lemuel Wellman Wright; 77; 186 Clinton st., Brooklyn; civil and mechanical engineer.

Q. 2. Were you formerly examined in the suit on 30th day of last April, on the part of the defendants?

A. Yes.

Q. 3. When did you begin the erection of St. Mary's Mills, at Chalford, Gloucestershire County, England?

A. In the year 1843 or '4. I cannot recollect the exact date.

Q. 4. When did you finish the construction of said mill and begin the manufacture of paper there?

A. To the best of my recollection it took about twelve months to fit up the mill and then I commenced to make paper.

Q. 5. When and to whom did you dispose of your interest in that mill?

A. I disposed of my interest to Robert Alexander Cochran, a Scotchman. I cannot give the exact date, but I should think it was some time in the year '45.

Q. 6. After that period you had nothing to do with St. Mary's Mills or the manufacture of paper there, had you?

A. I had nothing whatever to do with the management or making of paper there after that period.

397 Q. 7. In the manufacture of paper at St. Mary's Mills, Chalford, or elsewhere, or in the manufacture of pulp at Spring Mill, at Chalford, or elsewhere, did you ever use any article except wheat-straw?

A. I never used any article except wheat-straw at St. Mary's Mill, except I once used six tons of clover-hay as an experiment; nor did I use any other article at Spring Mill but wheat-straw and jute.

Q. 8. Were the boilers that were warranted to bear a pressure of one hundred pounds put up and used by you at St. Mary's Mills or at Stockport, Cheshire County, England?

A. The parties who made the boilers stated, (I had no warranty or writing about it,) that they would bear one hundred pounds. I refer to the boilers put up at St. Mary's Mill.

Q. 9. What pressure did you use in the manufacture of paper from wheat-straw at St. Mary's Mills?

A. During the time of my management of the mill, I do not recollect using more than from forty to fifty lbs.

Q. 10. Did you make any change in the machinery and apparatus in St. Mary's mills after their completion? If so, when?

A. I did about three or four months after they were completed, as near as I can recollect.

Q. 11. Did you use so high a pressure there as forty or fifty pounds after the change was made?

A. Yes, I did. The change had nothing to do whatever with the boiling proeess. The change related principally to the washing process.

(Objection by complainants to last part of answer.)

Q. 12. Can you recollect the pressure that you usually employed in boiling wheat-straw in the manufacture of paper at St. Mary's Mills?

A. During my time, it was from forty to fifty, as near as I can recollect.

Q. 13. How was the pressure ascertained?

A. By a mercury-gauge and a safety-valve.

Q. 14. To what boiler and boilers was the mercury-gauge and safety-valve attached?

A. I had four boilers, the safety-valves were attached to them
398 all, but I do not think more than two of them had the mercury-gauge. I now recollect I had six boilers, three of them low-pressure and three of them high pressure. Three of them were used for driving two low-pressure engines, and one of them for driving two high-pressure engines, for driving two paper machines. Of these six no more than two had mercury-gauges, but all had safety-valves. The three boilers that were used to drive the two low-pressure engines, condensing-engines, were low-pressure boilers.

Q. 15. From which of those six boilers did you supply the kiers or boilers in which you boiled the straw in an alkaline solution?

A. There were two of the six that were set up to supply steam to the boilers in which I boiled the straw. They were the two that had the mercury-gauges on them.

Q. 16. Then your pressure of forty or fifty pounds was ascertained by the mercury-gauges and safety-valves on those two last-mentioned boilers, was it?

A. Yes.

Q. 17. Was there any other way of ascertaining the pressure under which you boiled straw in the manufacture of paper at St. Mary's Mills, besides those two mercury-gauges and safety-valves?

A. I do not recollect any other.

Q. 18. And when you say you boiled straw in an alkaline solution under a pressure of not more than forty or fifty pounds at St. Mary's Mills, you refer to the pressure as ascertained by those two gauges and safety-valves, do you?

A. Yes.

Q. 19. Please refer to your answer to the eighth interrogatory on your former examination in this cause, and state if you have not made an error in mentioning these 80 pounds.

(Objected by defendants that the printed book produced and shown to the witness is not the former examination referred to.)

A. That 80 pounds was put in where it is not intended to be put in
399 by me, but it applied to the kiers, or was meant to be applied by me to the kiers previously erected and worked by me at the bleach-works near Stockport, Cheshire County, England.

Q. 20. Then, if you have previously stated in this cause that any pressure above fifty pounds was used by you in boiling in a solution of caustic alkali, such statement is not correct, except in respect to the boiling that was carried on at Stockport. Is that so?

A. Yes. I meant to be correct, but did not understand how it was put down at the time.

Q. 21. What was the position of those two boilers from which you supplied steam to the kiers in which you boiled the straw in caustic alkali under pressure at St. Mary's, with reference to those kiers?

A. The kiers were inside the building—four of them set in row, side by side. I cannot swear whether there were three or four of them, but my impression is there were four. The two high-pressure steam-boilers

were on the opposite side of the building; outside of the building, close up; just a passage between.

Q. 22. What was the distance across the building and between the kiers and the steam-boilers?

A. I should think about forty feet. I think the building was fifty feet wide; but as the pipes reached only from the center of the boilers to the center of the kiers, I should say the distance between the kiers and the boilers was forty feet.

Q. 23. How were the kiers and the steam boilers connected?

A. By a five-inch cast-iron pipe that run from the boilers to the kiers. The steam was introduced through those pipes.

Q. 24. Where did the steam enter the kiers?

A. At the bottom of the kier just above the spherical end.

Q. 25. What part did you take in the manufacture of paper from straw at St. Mary's Mill before and after the alteration.

A. I superinteded the whole process.

Q. 26. Did you have men under you whose duty it was to attend to the steam-boilers and others to attend to the kiers during the manufacture?

400 A. Yes.

Q. 27. Then you did not, personally, watch the steam-boilers or the keirs during the manufacture, did you?

A. I did personally watch the process every day, but I did not do all the work. I had a foreman—two foremen—a day foreman and a night foreman, and a good many men, and about thirty women.

Q. 28. What were the duties of the foremen?

A. To superintend and see that all the orders were executed, and the work done according to instructions—according to my directions.

Q. 29. Then you gave the foremen instructions about the pressure on the steam-boilers, and left it to them to carry out those instructions, did you?

A. Yes; they are always men who are brought up in the business, and understand the instructions you give them.

Q. 30 Then, what you swear in reference to the manufacture at St. Mary's Mills, you state from your recollection of the instructions you gave your foremen, do you?

A. Yes.

Q. 31. For how long was the boiling carried on in the alkali-kiers?

A. From six to eight hours.

Q. 32. How much, and what kinds of paper were manufactured at St. Mary's Mills while you were connected with them?

A. About fifteen tons a week, as near as I can recollect, of brown paper, paste-board, and jacquard-board for weaving. Some white paper was made at the first go-off of the mill. There was not much made—from fifteen hundred pounds to a ton, perhaps.

Q. 33. What was done with the white paper made there?

A. To the best of my recollection it was sold.

Q. 34. Have you any sample or specimen of that white paper? If so, please produce and annex the same to your deposition.

A. I have none with me. I did not know that it would be required. I have got some at my house.

Q. 35. Please produce some, and have the same annexed to this your deposition.

A. I will do so.

401 Q. 36. How was the caustic-alkali, in which the straw was boiled at St. Mary's Mills, during your superintendence, prepared?

A. It was prepared by mixing lime boiled with the steam, with alkali, in an iron vessel.

Q. 37. What kind of alkali was used?

A. Common soda-ash, commonly called in England, soda-ash of commerce.

Q. 38. Was there any difference in the strength of the solutions between the manufacture of white paper and of brown?

A. The strength, generally, was about the same, only it requires two boilings for white paper, which would consume a good deal more alkali.

The further examination of witnesses is adjourned to 10 o'clock, Thursday, June 6th.

JUNE 7TH—1 *o'clock.*

Mr. Russell proceeds with the cross-examination of the witness Lemuel W. Wright, after waiting until quarter of two o'clock without Mr. Nye, counsel for complainants, appearing:

39. Q. X. Did you boil any straw in caustic-alkaline solution under high-pressure steam in your mill at Stockport? If aye, at what pressure?

A. I did. As high as 80 or 90.

40. Q. X. Had you found any advantage in the use of such high-pressure for bleaching purposes? If any, what advantage?

A. I did find advantage in it. I found, from experience, that in using high-pressure, that the caustic alkali had a much greater effect. In boiling at 80 or 90 I found that I gained by high-pressure a much greater heat; consequently, the alkali acted to an advantage equal to the increase of heat.

41. Q. X. In boiling straw at your mill at St. Mary's, did you, during the process, see whether your instructions were followed by your subordinates; and did you see that the pressure in the steam-boilers
402 supplying the pulping-kiers actually ranged as you had directed? Did you frequently notice the pressure used?

A. I attended personally to the business, and did see that my subordinates followed my instructions. It being a new process, which the men were not acquainted with, I was obliged to be there constantly, often from 6 o'clock in the morning until 12 o'clock at night, teaching the men how to proceed, there being two sets of men, one for the day and one for the night. I frequently noticed the pressure used.

42. Q. X. With respect to your boilers at Stockport, were they constructed to bear a higher pressure than your boilers used at St. Mary's Mills? If so, how much higher?

A. The boilers at Stockport were constructed to bear a much higher pressure than those used at St. Mary's. The Stockport boilers would, I have no doubt, safely bear 200 lbs. pressure.

43. Q. X. How were the Stockport boilers constructed?

A. They were cast-iron boilers, of conical form. The bottoms were two inches thick, with deep flanges; the sides were one and a half inches thick; the top two and a half inches to three inches thick, of the full size of the kier, overhanging flanges, and bolted down with sixteen bolts one and a quarter inches in diameter, wrought-iron round bolts, with nuts to match.

44. Q. X. Were the pipes conveying steam to the boiling or pulping kiers covered or insulated from the atmosphere?

A. Yes; they were.

45. Q. X. Was there any, and if any what, difference, in your opin-

ion, between the steam-heat and pressure in the steam-boilers, and the boiling-kiers?

A. I do not suppose there was any difference.

46. Q. X. In bleaching cloths, and other textile materials, at your mills, at Stockport, in the years 1839 and 1840, and so on, by boiling the materials to be bleached in caustic-alkaline solutions, under high-pressure, did you clarify the caustic alkali before putting it into the kiers, so as to divest it of the lime, by allowing it to subside previous to the use of such solution?

A. Yes; I did.

403 47. Q. X. Knowing the advantages of the process of clarifying the caustic alkali, mentioned in your last answer, when you used it for bleaching clothes, did you adopt the same plan in boiling straw in caustic-alkaline solutions, under high steam-pressure, to make white paper at Chalford, or any other plan? If so, state what it was.

(He objects to answer on the ground that it is a valuable secret to him. Question withdrawn.)

2.30 O'CLOCK.—Mr. Nye, counsel for complainants, here enters and states that he has been detained at the examination of defendants' witnesses, Vossnack and Renwick, and objects to the further continuation of the cross-examination, and enters a general objection to the cross-examination.

Q. 48. Did you use any milk of lime in your kier in boiling the straw in caustic-alkaline solution, under high steam-pressure?

A. I did.

Q. 49. Have you set up, in France, Ireland, and Russia, any of your patent high-pressure boilers or kiers for bleaching fibrous substances, by boiling the same in caustic-alkaline solutions, under high-pressure, similar to the boilers or kiers which you had at Stockport? If so, state when and where you set up such boilers or kiers.

A. Yes; I did. I set one up near Belfast, in Ireland, about the year 1839 or 1840; that was for bleaching linens and linen-yarns. I set up three in France, in the vicinity of Rouen, about the same time. I sent one to Russia, and my foreman and one other man, a bleacher, went with it to set it up at Alexandria, near St. Petersburg. The Emperor bought it of me, and gave me £800 sterling for it. That was about '38 or '9.

Q. 50. If, in treating straw to make white paper, you subject the straw to a boiling at forty pounds pressure in caustic alkali with milk of lime, and then wash or crush and beat the material into a pulp, and then boil that pulp a second time in a solution of caustic alkali,

404 is there any use or benefit in using on such second boiling a higher steam-pressure than 40 lbs. to the inch.

(Objected to by complainants; also, to form.)

A. No; I do not think there is.

Q. 51. Do you make a better article of white straw-paper by the two boilings at the pressure mentioned in the last question, 40 lbs. to the inch, than you would by one boiling at a much higher pressure?

(Objected to by complainants.)

A. I make a much better paper by the second boiling; get a much purer white; from experience it has been found that a second boiling after being in chlorine or chloride is necessary in all instances where you want to get pure colors; for instance in dyeing different colors, blues in particular.

Q. 52. State the difference, if any, in boiling wheat and rye straw—making good white paper.

(Objection by complainants.)

A. The difference is, that the wheat-straw contains a larger proportion of silex than oat or rye straw or barley; consequently the wheat-straw requires a greater quantity of caustic alkali and lime to dissolve the silex and take up the coloring matter.

Q. 53. Was your process for which you obtained the patent in England for making paper from straw, &c., a success, and was it so considered by the trade when you practiced that process in England?

(Objection by complainants.)

A. In my opinion it was a decided a success. I believe it was generally so considered by the trade. The largest and best paper-maker in England for writing papers, Joynson & Co., of St. Mary Cray, in Kent County, made paper for me from straw of my preparation, at Spring Mill. After making the paper he purchased a license from me, paying £600 in money and £200 in machinery for the privilege of making six tons of paper a week. This was about the year 1850 or '51; it might be 1852; I do not think it was so late as 1853.

405 Q. 54. Did Mr. Charles Cowan, a paper-maker of Edinburgh, take any license from you for the use of your process or have anything to do with it?

A. No. He didn't take any license. He used the process without the license. He set up a mill at Dundee, and I was informed carried on the process there; and he wrote me a letter on the subject, dated Edinburgh, Feb'y 7th, 1846. I will furnish a copy to be attached to the examination to be marked Defendants Exhibit F, C. W. N., examiner.

Q. 55. In your English patent, to which you have referred in your previous testimony in this case, you speak of the use of high-pressure and steam in your process of boiling straw, &c. Please state what you meant by the words "high pressure steam?"

(Objection by complainants.)

A. I meant any pressure that could be worked above atmospheric pressure. I had a great idea at that time of high-pressure steam and caustic alkali for dissolving the coloring and gummy matters contained in fibrous materials. For instance, I discharged about one thousand pieces of printed goods, fast colors, made by Hoyle & Co., the most celebrated calico-printers in the world. These goods were called misprints. I discharged the colors so that they could be printed again. That was about 1839 or 1840.

Q. 56. Did you mean, and intend when you applied for that English patent of 1843, to use steam of high pressure in the manufacture of paper from straw, etc. If so, how high did you consider you had the right to go under that patent?

(Objected to by complainants.)

A. I considered I had the right to go as high as I pleased—as high as the vessels would stand it.

Direct resumed:

Q. 57. When you say that the boilers which were stated to bear 100 pounds were put up at St. Mary's Mills, do you refer to the two high-pressure boilers which were set up outside of the building?

A. Yes; they were the steam boilers outside of the building for raising steam, and I refer also to boilers inside of the building.

406 Q. 58. What boilers inside of the building do you refer to?

A. I refer to boiling-kiers.

Q. 59. Do you remember whether these kiers were tested by you. If

so, state if you recollect what pressure they were found by you capable of withstanding?

A. They were not tested by me to my recollection. I took it for granted they were sufficiently strong for all my purposes.

Q. 60. Is the apparatus and machinery that you have referred to in your former examination of the 30th of April, as used at St. Mary's Mills, correctly described in your English patent of 1843?

A. It is not as it was described exactly. We don't always follow the specification, that is, it may not be exactly described there, only in the principles of the construction; that cannot be avoided in carrying out the proper effect intended under the patent.

Q. 61. Are the steps of the process and their order to which you referred in your said examination, correctly stated in your English patent of 1843?

A. As near as I can recollect they are; but when the mill was first fitted up it was arranged very near like the specification—similar to the specification in the different operations to be performed. That was for making white paper. But when it was decided to make brown paper instead of white paper, some four or five washing tubs and other things were removed and other means adopted for washing principally. The boiling-kiers, steam-boilers, etc., were set and remained nearly the same.

Q. 62. In giving your evidence on the part of the defendants, in that examination, did you have in mind the machinery, apparatus, and process employed at St. Mary's Mills in the period of time after the alterations in the mill or in the period before?

A. All the evidence that I gave referred principally to the manufacture of brown paper, as there was but a small quantity of white paper made at St. Mary's Mills. The change was made pretty soon after the mill was fitted up. It might be three months, perhaps; it might
407 be six. I can't recollect. It's of no use. The manufacture of brown paper was after the alterations had been made in the mill.

Q. 63. Was the apparatus and machinery set up at St. Mary's Mills in exact accordance with your patent of 1843. If not, state in what respects the apparatus and machinery originally constructed there differed from the apparatus and machinery described and specified in your patent?

A. That is a question no man can answer. It was very much like the patent, according to my recollection.

Q. 64. State, if you recollect, any difference between the machinery and apparatus of St. Mary's Mills and the machinery and apparatus of the patent, taking the mill as it was originally fitted up?

A. I do not recollect any difference.

Q. 65. Was the process originally used at St. Mary's Mills exactly the same as that described and specified in your English patent of 1843?

A. I went to work in the first instance as near as may be in accordance with the patent. I couldn't say exactly the same. I cannot recollect exactly what was used there. I cannot recollect the number of vessels, the different bits of machinery, and the position of them. I do not recollect the relative position of the vessels, nor do I recollect the order of the washings without referring to the specification.

Examination resumed June 8th, at 11 o'clock. Present, counsel for respective parties.

Q. 66. Please refer to your English patent of 1843, No. 9787, and the drawings thereto annexed, particularly sheet one, which are now shown to you, and state, if you recollect, whether any parts of the machinery

and apparatus therein described were omitted in the original construction of St. Mary's Mills?

A. St. Mary's Mills was first set to work with a view of making white paper. At a certain time afterwards it was decided between me and my partner to make brown paper instead. When the mill was first put up, I followed pretty nearly the description and drawing in the patent. I do not recollect about any particular part being omitted.

408 Q. 67. State if you recollect whether any machinery or apparatus was added in that original construction to the machinery and apparatus set forth in the patent and drawings?

A. No, I do not recollect that there was.

Q. 68. How many kiers were originally set up at St. Mary's Mills for boiling the straw?

A. Four or five; I forget which.

Q. 69. Please refer to your last-mentioned patent and drawings now shown you, and state if you recollect whether the same process and the same order of the various steps of the process were used at St. Mary's Mills, in the commencement in the manufacture of white paper, as are mentioned and described in said patent and drawings.

A. I have referred to the patent and drawings. As far as we proceeded in making white paper, in the first setting up of the mill, the process and order were nearly the same as described in the patent and drawings as near as I can recollect.

Q. 70. In your first boiling of the wheat-straw, at St. Mary's Mills, for the manufacture of white paper, in the close kier, did you treat the straw with milk of lime without any alkali?

A. No; I did not.

Q. 71. Do you recollect positively that you did not?

A. No, I did not. Although it is spoken of in the specification, as to be treated of in that way, I was not bound to follow the specification in all the technicalities of construction and process that were not important to the process of making paper.

Q. 72. In your second boiling at St. Mary's Mills for the manufacture of white paper, did you use alkali in your kier, of the strength of 2° No. 1 hydrometer?

A. I used higher strength.

Q. 73. Do you recollect what strength you used? If so, state it.

A. To the best of my recollection it was from 6 to 8 degrees by the English hydrometer.

Q. 74. Produce the samples of white paper manufactured at St.
409 Mary's Mills in the first operations there, that you said you would produce in answer to the 35th interrogatory, and annex the same to your deposition.

A. Here it is.

(Witness produces printed letter of Charles Corwan, marked Exhibit A B, on the part of complainants, June 8th, 1861, C. W. Newton, U. S. examiner.)

Q. 75. Please refer to your patent of '43, as requested in 66th interrogatory, and state if you recollect what parts of the machinery, apparatus, and process therein described were omitted in making the alterations in St. Mary's Mills for the manufacture of brown paper?

A. I have referred to the drawings and patent, especially the drawings, sheet 1, Figure 1 and 2, and find, to the best of my recollection, that tubs B, C, and G were removed; and tub E remained, as near as I can recollect, where it was fixed. The boiling kiers remained nearly the same; also the pulping or crushing machinery. Those that were left

remained in the same position as originally. The process was of course different in making the brown paper from the white, with exception of boiling and pulping—I can't go through the minutiæ.

Q. 76. Did you, in the manufacture of brown paper at St. Mary's Mills, boil the straw twice in the close kier?

A. No; once was found sufficient for brown paper.

Q. 77. Did you, in the manufacture of brown paper at St. Mary's Mills, treat the straw with sulphuric, muriatic, or other acid, or was that part of the process mentioned in your patent of '43 a part of that which was omitted after the alterations were made?

A. I did not treat it with these chemics or acids. It was not found necessary in making brown paper. Those steps of the process were a part of that which was omitted in making brown paper.

Q. 78. Did you boil the straw at St. Mary's Mills, in the manufacture of brown paper, in milk of lime, before you boiled it in the close kier?

A. I did not.

Q. 79. In the manufacture of brown paper at St. Mary's Mills, did you boil the straw in the close kier in an alkaline solution?

410 A. I boiled the straw in an high-pressure boiler with caustic alkali and milk of lime.

Q. 80. What was the difference between the process used by you at St. Mary's Mills, in the manufacture of brown paper and that of white, up to the boiling in the close kier in a alkaline solution?

A. The difference was that the straw for white paper was boiled twice, and that for brown once.

Q. 81. State, if you recollect, at what stages in the process those two boilings for white paper took place?

A. The straw for white paper was boiled in the kiers washed and pulped under the crushing rollers, washed again, and put into the kier and boiled a second time; when, after being washed, it was ready for *chemiking* for making it white. In the first boiling the straw was put in the kier after being cut in lengths of about one inch. I left out in the operation the boiling in milk of lime mentioned in the patent.

Q. 82. State, if you recollect, what process the straw for brown paper was subjected to at St. Mary's Mills up to the boiling in the close kier?

A. It was cut into lengths of one inch. That was the only process.

Q. 83. What was the capacity of St. Mary's Mills for the manufacture of brown paper, and how much was made under your superintendence?

A. The capacity was equal to making from fifteen to sixteen tons a week. Two paper machines were kept running day and night. At the latter part of my superintendence I believe we were making about fifteen tons a week of pasteboard, jacquard-board, and this paper, like this sample.

Q. 84. Is not your recollection of the construction, alterations, and operation of St. Mary's Mills very vague and indistinct?

A. I think, from the evidence I have given in this case, it will appear very evident that my recollection was pretty good, considering the lapse of time.

Q. 85. How many different patents have you taken out on different subjects?

A. I have had forty or fifty, I should say.

411 Q. 86. What sort of boiling of straw did you do at Stockport in '39, or thereabouts?

A. The boiling of straw that I went through with at Stockport was the first experiments that I made on wheat-straw for the purpose of making pulp for paper. I put straw in bags into the high-pressure

kiers, at Stockport, with the linen and cotton goods that were being bleached at the time, and submitted it to caustic alkali at a pressure of steam to 80 or 90 lbs. This was all for experiment.

Q. 87. Did anybody, to your knowledge, ever succeed in the manufacture of good paper from straw before you obtained your English patent of 1843. If so, who?

A. I do not recollect anybody in England. I don't know about this country at all. I believe I am the first one that made first quality paper from straw, and I believe the paper trade understands it in that way; and I am called the father of straw-paper making.

Q. 88. Was Spring Mill fitted up in accordance with your patent of 1843?

A. The main principles of the patent were carried out at Spring Mill by boiling straw with high-pressure steam, caustic alkali, and milk of lime.

Q. 89. The machinery and apparatus set up and used at Spring Mill were different from the machinery and apparatus described in the patent, were they?

A. The machinery set up at Spring Mill was different in some particulars from what is specified in the patent, except the high-pressure kiers. We left out a great deal—parts—similar as in making brown paper at St. Mary's Mills—I adopted a similar way of bringing it to the boiling process—the high-pressure boiling process.

Q. 90. How much white paper did you make at Spring Mill?

A. I did not make any.

Q. 91. How much pulp for white paper did you make there?

A. As near as I can recollect, about 15 or 1600 weight. That was make for experiment at the first starting off. That mill was got up and intended for the purpose of making pulp alone; but that intention was frustrated by the death of the party who associated with me in the enterprise, who went and hanged himself.

412

Q. 92. When did you begin your operations at Spring Mill?

A. About 1850 or '51; might be '52.

Q. 93. Please to refer your answer to the 7th interrogatory, on your former examination on the 30th of April, now shown you in the printed book, and state if you have not made a mistake in saying that the samples produced by you and marked Defendants Exhibits N, O, P, were made by you from straw-pulp at Chalford, about 1848?

A. Of course they could not be made by me there, because I was not there. Those samples were made at Spring Mill, which is also at Chalford, in 1851. Some mistake must have been made somewhere, assuming that the printed book is right.

Q. 94. Who was your associate in the construction and operation of St. Mary's Mills?

A. Robert Alexander Cochran. He was my partner, and I afterwards sold out to him.

Q. 95. How much did the fitting up of St. Mary's Mills cost?

A. About 15 or £16,000. I do not know exactly. I did not keep the books.

Q. 96. What portion of that sum did you contribute?

A. About £4,500.

Q. 97. Did you put in that amount in cash?

A. The most of it. I sold half of my patent for £5,000, and I put in nearly all of it. I sold it to the Hon. Hannah Jane Cochran.

Q. 98. What relation was she to your partner?

A. His mother.

Q. 99. Did the money for your half of the patents actually come into your hands, or paid over for the expense of fitting up the mill?

A. It was paid into my hands.

Q. 100. Did she furnish the money for her son's share of the expense of fitting up the mill?

A. I do not know anything more about it than you do.

Q. 101. What price did you sell out St. Mary's Mills for, and how much did you get?

413 A. I sold out the whole of the mills for 11,000 £11,500, I do not recollect which. I got £500, which was all I ever got, which was paid on the day the deed was signed.

Cross-examination:

Q. 102. Did you, after selling out St. Mary's Mills, fit up another mill at Chalford for the manufacture of paper-pulp from wheat-straw? If so, when?

A. I did, in 1851 or '52; somewhere there. That was Spring Mill.

Q. 103. With respect to the samples, Defendant's Exhibits N, O, P, referred to in your previous testimony in April last, state where you made the pulp for that paper, and that paper, and when, and how?

(Objection by complainants to the form.)

A. I made the pulp for that paper at Spring Mill. I did not make the paper there. The pulp was made about the year 1850 or 1851. The paper I superintended the making of it at St. Mary Cray, in the county of Kent, at Mr. Johnson's mill. The paper was made within a week or two after the pulp was made. I took the straw and cut it to a certain length convenient for handling. I then put it into a high-pressure kier or boiler, with caustic alkali and milk of lime, and boiled it for several hours—six or seven hours. It was then blown up into a tub or receptacle, and from that drawn into a washing-engine—a common rag-engine, and from the rag-engine—it being a sufficient height to run back—into the boiling kier again. It was then boiled in caustic alkali 3 to 4 hours, without the milk of lime, under pressure from forty to fifty pounds. It was then blown up again by pressure of steam, and drawn into the rag-engine, and washed as before. I omitted to state that, after the first boiling and washing, the stuff was pulped under crushing-rollers, and then washed for the second boiling. After the second boiling and washing—after such second washing, it was run into a tub to be bleached with chloride of lime liquor.

(Objection by complainants to admission of all of the answer concerning the process employed at Spring Mill.)

414 Q. 104. Was the color of those samples referred to in the last question the same when the paper was made as it is now? If there is any difference, state what has caused it.

(Objection by complainants.)

A. The paper when made was whiter than it is now. The cause of the difference is that the water used in making the paper was highly charged with sulphate of lime; and that and the time since which it was made have caused the change of color.

Q. 105. Please produce the sample of their brown paper made from wheat-straw at St. Mary's Mill, as you have testified. The sample referred to in your answer to the 83d interrogatory to be put in evidence in this cause.

A. Here it is.

(The paper is here marked Exhibit V, on the part of the defendants, June 8, 1867.)

Redirect:

Q. 106. Is the effect of boiling straw in an alkaline solution, under pressure, accurately stated in your English patent of 1843, as you understood it?

A. Yes; I believe so.

Q. 107. Does your American patent of March 27th, 1847, describe the apparatus, machinery, and process used by you at St. Mary's, or mentioned in your English patent of 1843?

A. I believe it so described. I did not have the enrolling of it. I have never seen the patent-letters or the drawings.

Q. 108. How much straw was requisite, as you treated it at St. Mary's Mills, to produce a cwt. of pulp for the manufacture of white paper?

A. It would take three cwt. to make a cwt. of paper; this was wheat-straw. I never worked any other straw.

Q. 109. How much straw was requisite, as you treated it at St. Mary's Mills, to produce a ton of pulp for the manufacture of brown paper, pasteboard, &c.?

A. It took a ton and a half to make a ton of brown paper.

Q. 110. Were any other attempts, to your knowledge, anywhere made to put in operation the invention claimed in your English patent of 1843 except those you have mentioned at St. Mary's Mills and Spring Mill?

A. None except what I have said about Hope Mill.

415 Q. 111. How much bleaching-liquor did you use in the manufacture of the white paper you made at St. Mary's Mills, and of the pulp for white paper you made at Spring Mill?

A. About one pound of chloride of lime-powder to five or six pounds of paper.

LEMUEL W. WRIGHT.

Subscribed and sworn to, this 8th day of June, before me,

CHA'S W. NEWTON,
U. S. Examiner.

MONDAY, *June 10th*, 1867.

HUGH BURGESS, produced and duly sworn on the part of the complainants, deposes and says:

Q. 1. What is your name, age, residence, and occupation?

A. My name is Hugh Burgess; am forty-one years old, and reside at Royer's Ford, Montgomery County, Pennsylvania; by occupation a chemist.

Q. 2. Have you been before examined in this suit?

A. I have.

Q. 3. Look at the several pieces of paper and specimens now shown to you, and marked by the examiner—

Complainants' Exhibit, No. 1, C. W. N.
" " " 2, "
" " " 3, "
" " " 4, "
" " " 5, "
" " " 6, "
" " " 7, "
" " " 8, "
" " " 9, "
" " " 10, "
" " " 11, "
" " " 12, "

" " " 13, "
" " " 14, "
" " " 15, "
" " " 16, "
" " " 17, "

416 respectively, and state if you know what each of said exhibits is, and from what and where made.

A. I know what each of the exhibits are composed of, and from what made and where made, that is to say: Each of the exhibits, 1 to 9, inclusive, is made of all wood, being a mixture of poplar and pine; and numbers 10 and 11 are all pine. Number 12 is poplar wood, in a chip form, ready for being placed in the alkali-boiler; it has been simply cut into chips. Number 13 is unbleached poplar-pulp, as discharged from the alkali-boiler; this exhibit is the result of simply boiling the chips, Exhibit 12, in caustic alkali, under the necessary pressure. Exhibit 14 is bleached poplar-pulp, and is the same as Exhibit 13, after being simply treated with bleach. Number 15 is pine wood, in a chip form, ready for boiling, placed in the alkali-boiler; it has been simply cut into chips. Exhibit No. 16 is unbleached pine-pulp, as discharged from the alkali-boiler; this exhibit is the result of simply boiling the chip, Exhibit 15, in caustic alkali, under the necessary pressure. Number 17 is bleached pine-pulp, and is the same as Exhibit 16, after being simply treated with bleach. All these pulp and paper exhibits were made at Royer's Ford, at the mill of the American Wood-Paper Company

Q. 4. State, if you know, whether these exhibits, marked from 1 to 11, inclusive, and 13, 14, 16, and 17, were made respectively according to the process described and specified in the re-issue No. 1449, and whether said Exhibits 13, 14, 16, and 17 are the article claimed and described in the re-issue No. 1448?

A. They are.

Q. 5. Did you see the setting and erection of the boilers used in the mill of the American Paper Company, at Royer's Ford, for the boiling of wood, &c., in caustic alkali, under pressure, and do you know by whom those boilers were made? If yea, state who was their maker, and the manner and circumstances of their erection, and how they have stood since they were set up.

A. I saw the erection and setting of the wood-pulp boilers, at Royer's Ford. Those boilers were made by Stanhope & Supler, of Frankford. These boilers are entirely enclosed in brick work, with the except-
417 tion of their man-heads, and the lower portion of the boiler to which heat was applied. This lower portion was invisible unless a person stooped into the fire chamber and looked upwards. No person, except those engaged around the mill and the builders of the boilers, knew that such boilers were erected, no strangers of any kind being admitted into the works, notices to that effect being placed over all the doors and gateways. The boilers stood in a shed or building which was open to a general view of those passing into the mill; the only parts visible was where the safety-valves, man-heads, blow-off cocks and pipes. The position has not been changed from the time of their erection until a month or two ago, nor was any change made to the surrounding brick-work, until a recent date.

Q. 6. State, if you know, how those boilers have been used at that mill in respect to the opportunity of seeing them had by others besides those engaged in the mill?

A. I know of no opportunity which others besides those engaged in the mill had of seeing the boilers, as they were entirely surrounded by

brick-work, which was at rare intervals only, partially removed to repair the boilers. As no strangers were allowed into the mill, they could not have the opportunity of seeing the boilers when the brick-work was removed.

Q. 7. When were those boilers erected at Royer's Ford?

A. To the best of my recollection they were erected in the spring or summer of 1860.

Q. 8. Do you know Morris L. Keen, of Royer's Ford, the patentee of two certain improved boilers mentioned in letters-patent granted to him by the United States in 1859 and 1863, and annexed to the bill of complaint in this cause. If yea, state if you know, what connection, if any, said Keen has had with the erection and use of those boilers at Royer's Ford?

A. I do know the said Keen. He personally superintended the erection of his patented boilers at Royer's Ford, referred to in previous answers, and he has superintended the working of them since that time.

Q. 9. Is said Keen, to your knowledge, a stockholder in the American Wood-Paper Company; and if so, for how long?

418 A. He is, and has been so, since the formation of the company.

Q. 10. Who were the owners of the mill you have referred to at Royer's Ford, at the time of the erection of those boilers, and when did the ownership change?

A. Messrs. J. & D. George, who, I believe, sold the mill of the American Wood-Paper Company; in 1866.

Q. 11. Who operated said mill before the same came into possession of the American Wood-Paper Company?

A. Messrs. Ladd & Keen & Walsh, the latter for a limited time only. Ladd & Keen worked the mill at the time, and subsequent to, the erection of Keen's patent boilers, referred to in the previous answers, and until the American Wood-Paper Company became possessors of the mill.

Q. 12. Were the samples above mentioned and marked from 1 to 17, inclusive, except 12 and 15, produced according to the process described, and claimed in the original Watt & Burgess patent of 1854; and are said samples marked 13, 14, 16, and 17, respectively, the articles mentioned and described as the product of the process described in said patent?

A. They were not, but they were produced by the process always adopted by us in practice, and the pulp exhibits are the same character as those produced at and since the time of the granting of the patent.

HUGH BURGESS.

Subscribed and sworn to before me, this 10th day of June, 1867.

CHA'S W. NEWTON,
Examiner, &c.

419

420 United States circuit court, eastern district of New York.

THE AMERICAN WOOD-PAPER COMPANY
vs.
THE FIBRE-DISINTEGRATING COMPANY. } In equity.

Depositions of witnesses on the part of the complainants, taken under a rule of the circuit court of the U. S. for the eastern district of New York, and by the consent of the parties, before Henry Phillips, jr., a commissioner of the United States, in and for the eastern district of Pennsylvania, at his office, No. 524 Walnut street, in the city of Philadelphia.

1867, JUNE 27. Present, H. E. Wallace, esq., counsel for the complainants; George Harding, esq., counsel for the defendants.

MORRIS L. KEEN, a witness, being produced and duly sworn, doth depose and say:

Q. What is your name, age, residence and occupation?

A. Morris L. Keen; years old; Royer's Ford.

Q. Were four boilers furnished by Stanhope & Supplee, in 1859 (furnished to the works at Royer's Ford) made and put up under your personal direction?

A. They were.

Q. In what part of the works were they set up, and how were they set up; and was there any precautions taken to prevent access to the works by others than those employed therein?

A. They were set up in a central part of the works in an enclosed building, in brick-work, entirely surrounding the boilers. There was no portion of the boilers visible to the eye of any visitors who might
421 surreptitiously gain admittance. Over all doors of entrance to the mill we had posted "no admittance."

Q. Did you actually keep strangers out?

A. No one was admitted. Strangers were turned out when found there. Sometims stragglers got in who would get in anywhere; then I turned them out.

Q. How long did it take to set up those boilers in their place in the brick-work?

A. About two months' time. All the four boilers were set together.

Q. After they were set up did any time elapse before they were used; and was that use experimental, and for how long?

(Mr. Harding objects to this question.)

A. As soon as the boilers were finished they were used for two or three months experimentally, on different kinds of stock and charges.

Q. Was that use entirely under your direction and control?

(Mr. Harding objects to the question.)

A. It was.

Q. Was there any other person about the establishment that could use that boiler except under your direction; and if so, what person?

(Mr. Harding objects to the question.)

A. There was no one except Mr. Burgess knew anything about the manipulation, and we had constantly conferences together; as I had charge of the working part of the mill, the directions were issued by me.

Q. Did you, as soon as you were satisfied with the results of these experiments, did you make application for a patent or did you make application before, or can you state when you did make such application?

(Mr. Harding objects to the question.)

A. I cannot at present give the date of the application, but I am under the impression it was made prior to those experiments, and not based upon them.

Q. Was the boiler invented by you in public use, or on sale, for any length of time before you applied for your patent?

422 (Mr. Harding objects to the question.)

A. It was in public use, or exposed for sale.

Q. Did you ever furnish any drawings or countenance its use anywhere than at Royer's Ford, before the application for the patent?

(Mr. Harding objects to the question.)

A. I never did.

Q. Can you produce samples of paper and paper-pulp made by the Watt and Burgess patent?

A. I can.

Q. Look at the several pieces of paper and specimens now produced duced by you and marked by the examiner—

Complainant's Exhibit, No. 1, H. P., jr.
" " 2, "
" " 3, "
" " 4, "
" " 5, "
" " 6, "
" " 7, "
" " 8, "
" " 9, "
" " 10, "
" " 11, "
" " 12, "
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" " 14, "
" " 15, "
" " 16, "
" " 17, "

respectively, and state, if you know, what each of said exhibits is, and from what and when made?

(Mr. Harding objects to this question on the ground that it is introducing new testimony not in rebuttal of the depositions of Stanhope or Rogers, taken at Philadelphia, for which purpose only the case was re-opened.)

A. I know what each of the exhibits are composed of and from what made, and where made, that is to say: Each of the Exhibits, 1 to 9, inclusive, is made of all wood, being a mixture of poplar and pine,
423 and numbers 10 and 11 are all pine. Number 12 is poplar wood in a chip form, ready to be placed in the alkali-boiler; it has been simply cut into chips. Number 13 is unbleached poplar-pulp, as discharged from the alkali-boiler; this exhibit is the result of simply boiling the chip, Exhibit 12, in caustic alkali under the necessary pressure. Exhibit No. 14 is bleached poplar-pulp and is the same as Exhibit 13, after being simply treated with bleach. Number 15 is pine wood in a chip form, ready for boiling, placed in the alkali boiler; it has been simply cut into chips. Exhibit number 16 is unbleached pine-pulp as discharged from the alkali-boiler; this Exhibit is the result of simply boiling the chip, Exhibit 14, in caustic alkali, under the necessary pressure. Number 17 is bleached pine-pulp, and is the same as Exhibit 16, after being simply treated with bleach. All these pulp and paper exhibits were made at Royer's Ford, at the mill of the American Wood-Paper Company.

Q. State if you know if these Exhibits marked from 1 to 11, inclusive, and 13, 14, 16, and 17, were made respectively according to the process described and specified in the re-issue No. 1449; and whether said Exhibits 13, 14, 16, 17, are the articles claimed and described in the re-issue No. 1448.

A. They are.

(Mr. Harding objects to the question and answer for the same reason as before, and that the question is a leading question.)

Q. 2. Have you been associated with Hugh Burgess in introducing and working the invention of Watt & Burgess, for making paper-pulp

from wood; and if so, state how long you have been associated with him and when and where the association began?

A. I have been so associated with Hugh Burgess since 1854; first became acquainted with him on his arrival from England.

Q. 3. Describe the kind of vessel used in working said invention, the kind of liquid employed and the strength of the same, and also the pressure and temperature required; and state whether paper-pulp was produced by such process?

424 A. The kind of vessel employed was a rotary boiler about 8 or 10 feet long, 3 feet in diameter, made at the suggestion of Hugh Burgess, to stand a working pressure of 200 pounds to the square inch. The kind of liquid employed was caustic alkali in solution of a strength from 10° to 12° Beaumé. The pressures under which such boiler was worked was carried from 100 to 120 pounds, with a safety-valve weighted to represent those pressures. We had no steam-gauges, and paper-pulp of an ivory class was produced by such boilers, which was afterwards made into white-paper.

Q. 4. State whether pulp was produced by the process described before it was subjected to the treatment of chlorine, as described in the specification of the original Watt and Burgess patent?

A. An ordinary pulp was produced, but it was subjected to the treatment of chlorine, as described in the specification of the original Watt and Burgess patent. The woods employed at that time were of a resinous character.

Q. 5. State what was the action of chlorine on the pulp produced by boiling in alkaline solutions under pressure?

A. The action of the chlorine was to remove such interstitial and resinous matter as was not previously removed by the boiling of the wood in alkali.

Q. 6. State whether or not you have continued to work the invention of Watt and Burgess since 1854; and, if so, when, and to what extent?

A. I have continued to work the process in connection and association with Hugh Burgess since that time, at Royer's Ford, and continued to work it up to this time; likewise have constructed and arranged the wood-pulp works of the American Wood-Paper Company, at Manayunk. The extent has now grown to the production of fifteen to eighteen tons a day in both mills.

Cross-examined by Mr. Harding:

Q. 1. Who else was associated with you at Gray's Ferry, in 1854?

A. F. B. Houghton.

Q. 2. In what way?

425 A. Mr. Burgess, I understood, sold Mr. Houghton the patent. I knew nothing about the arrangement between Mr. Burgess and Mr. Houghton.

Q. 3. When did Mr. Burgess acquire his interest as a copartner with you?

A. At the time of the transfer to the American Wood-Paper Company.

Q. 4. What was the agreement between you and Mr. Burgess, prior to that time?

A. I had no agreement with Mr. Burgess, prior to that time.

Q. 5. State precisely what relations Hugh Burgess occupied to you from 1854 down to the time you sold out to the American Wood-Pulp Company, and in what way was he associated with you.

A. He was induced by Mr. Ladd and myself to remain, and develop or work out the process originating with himself, with an understanding that when the process was fully developed and a paying institution, that a pecuniary interest should be awarded him.

Q. 6. When was it that this inducement was held out?

(Objected to by Mr. Wallace.)

A. After Mr. Ladd and myself got control of the patent in this country, in 1855, I think.

Q. 7. What interest was it understood he should receive if he would remain and develop the invention?

(Objected to by Mr. Wallace.)

A. There was no defined amount or interest ever mentioned. It was left to Mr. Ladd and myself to tender him what we thought was right.

Q. 8. What portion of the profits, if any, did he receive prior to the sale to the American Wood-Pulp Company?

(Objected to by Mr. Wallace.)

A. He had no interest in the profits.

Q. 9. Did he receive any of the profit?

(Objected to by Mr. Wallace.)

A. He did not.

Q. 10. Did he receive remuneration for his services in any way?

(Objected to by Mr. Wallace.)

A. His current expenses were met by the institution.

426 Q. 11. In what capacity did you and Mr. Ladd regard him? As an employee or not?

(Objected to by Mr. Wallace.)

A. We did not regard him as an employee. His position was in no way defined, further than stated.

Q. 12. What were his duties?

(Objected to by Mr. Wallace.)

A. His duties are making and conducting various experiments and giving general instruction to carry out his patent in the manufacture of wood paper-pulp.

Q. 13. State more precisely what was the object of these experiments.

(Objected to by Mr. Wallace.)

A. To become familiar with all the details and possible manipulations connected with the invention.

Q. 14. When, if ever, was it that he succeeded in developing and working out the process, and making it a paying institution?

(Objected to by Mr. Wallace.)

A. It is difficult for me to define the exact time when the institution became a paying institution.

Q. 15. State as near as you can?

(Objected to by Mr. Wallace.)

A. I would say the institution fluctuated with the prosperity of all paper-makers; there were a great many ups and downs in it.

Q. 16. How was it in 1859?

(Objected to by Mr. Wallace.)

A. My memory does not serve me exactly. Without reference to our books I am not prepared to answer any questions on dates.

Q. 17. State, as near as you can, when the institution became a paying institution?

(Objected to by Mr. Wallace.)

A. There was money made in 1856, but expended in the extention and

alteration in our works. After 1856, all money that was made, if any, was expended in increasing and developing our works.

Q. 18. Who owned the works at Royer's Ford?

A. J. and D. George the real estate and a portion of the machinery.

427 (This question is objected to by Mr. Wallace.)

Q. 19. Who carried on the business, and what was the arrangement with J. and E. George?

(Objected to by Mr. Wallace.)

A. Ladd & Co. carried on the business. What arrangement Mr. William F. Ladd had, especially with the Messrs. George, I have no knowledge of.

Q. 20. Were you a partner of Ladd?

(Objected to by Mr. Wallace.)

A. I was interested with him.

Q. 21. Who composed the firm of Ladd & Co.?

(Objected to by Mr. Wallace.)

A. Transactions were always made in William F. Ladd's individual account.

Q. 22. Then you understood he was carrying on the business at Royer's Ford as an individual under the title of Ladd & Co. Is that so?

(Objected to by Mr. Wallace.)

A. William F. Ladd furnished the means and conducted the business as the principal and capitalist of the institution. My interest was an equal interest in the profits of the concern, if it proved profitable.

Q. 23. Did you receive a salary in addition; and if so, in what capacity?

(Objected to by Mr. Wallace.)

A. I did not.

Q. 24. Did the firm pay a rent to the Georges?

(Objected to by Mr. Wallace.)

A. The lease of the mill was made through William F. Ladd. I am not aware of the conditions of the arrangement. All business connected with the Messrs. George was privately arranged between them and Mr. Ladd.

Q. 25. Did the Messrs. George furnish money for construction account?

(Objected to by Mr. Wallace.)

A. They furnished Mr. Ladd funds. On what condition, I am not aware.

Q. 26. Who paid for the four upright boilers constructed by Stanhope & Supplee, and erected at Royer's Ford, in August, 1859?

(Objected to by Mr. Wallace.)

428 A. Messrs. George settled that account with Stanhope & Supplee, by furnishing the funds by some special arrangement with William F. Ladd. I know nothing of the arrangement.

Q. 27. Were those boilers like the boiler shown in Exhibit No. 1?

A. Yes, with the exception of two of the four were furnished with bottom conical screens.

Q. 28. Are those four boilers in use now?

A. Yes.

Q. 29. Whose property are they now?

A. The American Wood-Paper Company's.

Q. 30. When and from whom did they acquire them?

A. They acquired them in the transfer of our effects, or from a sale of the mill property by the Messrs. George. The time I cannot say.

Q. 31. How long did the firm of Ladd & Co. carry on business at Royer's Ford?

(Objected to by Mr. Wallace. H. E. W.—Q.)

A. From 1855 or 1856, to 1859 or 1860. About the time Samuel Walsh took possession of the mill.

Q. 32. Did Samuel Walsh carry on the business at the mill from the time Ladd & Co. stopped, in 1859 or 1860, until the sale to the American Wood-Paper Company?

A. Samuel A Walsh carried on the business in his individual name for the interest of Mr. W'm F. Ladd, myself, and himself.

Q. 33. Did he carry on the process of making pulp from wood to any extent at Royer's Ford?

(Objected to, as well as the last question, by Mr. Wallace.)

A. To the extent of from 9 to 12 ton per week, during that period, as near as I can recollect.

Q. 34. Was all the wood that was pulped during that time pulped in the four upright boilers which had been erected in 1859?

(Objected to by Mr. Wallace.)

A. It was.

Q. 35. From whom did the American Wood Company purchase the effects, and at about what time?

429 (Objected to by Mr. Wallace.)

A. It is difficult for me to answer that question. The transfer was made of the patent-rights by Ladd and myself, through negotiations made by sundry parties—Walsh, Ladd, and a man named Carson. I cannot define exactly who made the final agreement; I think it was brought about through Mr. Ladd.

Q. 36. What ownership had you, individually, in any effects but the patent?

(Objected to by Mr. Wallace.)

A. The ownership I held was in some property formerly at Gray's Ferry, the rotary boiler, shafting, pans, &c. That is all the interest I had in any property at Royer's Ford.

Q. 37. Have you ever examined the provisional specification of Watt and Burgess, of August 14, 1853?

(Objected to by Mr. Wallace.)

A. I have never examined that specification or a copy of it.

Q. 38. Did you ever examine the English specification of February 18, 1854?

(Objected to by Mr. Wallace.)

A. I don't think I ever examined that or a copy of it.

Q. 39. Were you consulted at the time of the purchase of the Mellier patent by the American Wood-Paper Company?

(Objected to by Mr. Wallace.)

A. It was talked about. I don't know that I was consulted, as the business was put in the hands of Walsh, Ladd, and Carson, to negotiate with the Wood-Paper Company, on the best terms they could obtain.

Q. 40. Do you know what was the object of the American Wood-Paper Company in purchasing that patent?

(Objected to by Mr. Wallace.)

A. The object was to complete the sale and transfer in a satisfactory manner to the American Wood-Paper Company of our patents. The American Wood-Paper Company asked of us to transfer the Mellier patent, at the same time we transferred our patent.

430 Q. 41. Did you understand that the last re-issue of the Watt & Burgess patent covered the working of straw under pressure in alkali?

(Objected to by Mr. Wallace.)

A. I did.

Q. 42. Can you give any explanation, then, why the Mellier patent was purchased?

(Objected to by Mr. Wallace.)

A. Nothing more than stated in my previous answer.

Q. 43. What is your interest in the American Wood-Paper Company?

(Objected to by Mr. Wallace, and the witness advised that he may decline answering the question if he has personal reasons for so doing.)

A. I decline answering. I am a considerable stockholder.

Q. 44. What office do you hold under the company, and what is your salary?

A. I am an engineer of the company. My salary is $5,000.

Q. 45. What is the lowest pressure at which you have carried on pulping for wood successfully at those works since you have been connected with them; and what is your usual pressure in working.

(Objected to by Mr. Wallace.)

A. I generally work from 140 to 160 pounds; gave no instructions to work below 140, considering that a safe pressure for working at. That is the pressure we work all kinds of wood at. I have never worked at any less than that. I never carried it to a minimum. I have carried it as high as 220; that is the highest.

Q. Please examine (Exhibit XX, Keen, H. P., jr,.) certified copy of the application of Morris L. Keen, on which letters-patent were granted June 16, 1863, and state whether that is the description of the four boilers which Stanhope & Supplee furnished to the Royer's Ford mill, in 1859.

A. It is.

Q. Were not the bottom screens, from time to time, introduced into two of these four boilers, as shown in Exhibit XXX, Keen, H. P., jr., when you worked straw, during the years 1859–1860, and were
431 not said screens removed from those two boilers when you worked wood in those two boilers?

A. The bottom screens were used when straw was cooked, to prevent the charge from burning when direct heat was applied. They were removed, as they were not required to cook-wood.

Q. Were not those bottom screens (marked L on the drawing) inserted and removed by persons going down into the interior of the boiler through the man-hole at the top, with a candle or lamp?

A. That was the method for removing the screens.

(Mr. Wallace objects to this and all the previous questions and answers.)

Q. Were you examined as a witness in the interference case between Dixon and Keen, and were you asked in said case what sort of boilers were used in 1859 for the manufacture of paper-pulp at Royer's Ford; and did you answer that they were upright boilers, four feet and a half outside, sixteen feet high, a perforated diaphragm across the top of the boiler, about two feet and a half below the top, with a man-hole in the centre of the said diaphragm, which was closed after the boiler was charged, with a light man-hole plate perforated; a conical perforated funnel was placed in the boiler connecting with the outside man-head through the boiler with a perforated disc. Said funnel was for the pur-

pose of conveying or guiding the stock being charged into the boiler through that perforated disc, thereby preventing any of the stock from lodging on the diaphragm. There were four boilers erected and completed, ready for work, in the latter part of August, 1859; and if you did say so, was it the truth?

(A certified copy of the testimony of the witness in the interference between Keen and Dixon is shown to the witness.

Mr. Wallace objects to the introduction in this way of testimony taken in another case.

Mr. Wallace, therefore, directs the witness to decline to look at the paper, and to decline to answer the question, as being insulting.

432 Witness declines to answer the question or look at the certified copy presented.)

Q. Did you, in the interference case above referred to, say that four boilers, such as were described in my last question, were erected at Royer's Ford, completed and ready for use in August, 1859?

(The certified copy of the testimony of the witness in the interference case, Dixon vs. Keen, marked Exhibit XXX, Keen, H. P., jr., is shown to the witness, and his attention called to the following passage in the fifth answer, to refresh his memory.)

"There were four boilers erected and completed, ready for work, in the latter part of August, 1859."

(Mr. Wallace objects to the introduction of testimony taken in any other case, and repeats his instructions to the witness as in the last question.

Witness declines to answer and to look at the exhibit.)

Q. Are you willing now to swear that the four boilers made by Stanhope & Supplee were not erected and employed in the latter part of August, 1859?

(Mr. Wallace objects to the question as before.

The witness can have reference to the record of his former testimony, now present, if he desires.

The witness objects to reading any former testimony, and declines to answer the question without referring to his books.)

Q. Were you examined in said case, as follows: "Can you determine from your books the exact length of time during which the boilers with perforated bottoms were used for cooking the stock in question at Royer's Ford? If so, examine the books and give the result of your examination." And did you say in reply, "I have before me the shipping-book and small construction account-book of Ladd & Co. In referring to Stanhope & Supplee's accounts, I find that, on page 16, construction-book, the boiler work was completed in August, 1859. I find on the shipping-book, first page, September 12, 1859, the first invoice of paper made from pulp, digested in these boilers by being boiled in water and blown out under pressure of steam when cooked. I

433 find by the same book a boat-load of it shipped May 25, 1860. June 17, 1860, seems to be a closing lot of shipments of the paper manufactured in these boilers.

(Mr. Harding says that a certified copy of the deposition of the witness in a former case is at his service to refresh his memory.

Mr. Wallace objects to the question and to the evidence offered.)

A. That is a correct statement of what I said on the occasion referred to.

Q. Is Exhibit XXX, Keen, H. P., jr., a correct representation of the boilers in which that straw was cooked, as referred to by you in the statement quoted in my last question?

A. That is a correct representation of the boiler. A steam-pipe was occasionally employed as an auxiliary to heat the contents of the boiler in addition to the fire-car H.

Q. Were you asked in that case "When did you begin to make paper-pulp of wood at Royer's Ford, in these boilers?" And did you answer "The first lot was made in November, 1860, which lot was shipped to Seymour & Co., New York. I find by the shipping-book there 23 casks of wood-pulp shipped to Seymour & Co., January 15, 1861. The pulp remained in casks at our place two months prior to shipment. Subsequent to that time I went to Seymour's mills, at Morristown, New Jersey, and made the same pulp into paper for the New York Tribune and World. The Tribu'e of January 29, 1861, was printed on it, and the weekly World of January 2d, 1861, was printed on it. At this time the attention of Samuel L. Walsh was given to the organization and management of a new firm."

(The witness is tendered a certified copy of his testimony for his inspection, if he desire.

Mr. Wallace objects to the question.)

A. I gave that testimony, and it is correct. That all came from our books.

Q. Is Exhibit XXXX, Keen, H. P., jr., a correct representation of the boilers in which that wood was cooked?

A. It differs from Exhibit XXX in having the moveable screens at the bottom removed.

434 Q. Did the introduction of the bottom screens, in cooking straw, affect in any way the operation of the upper screen-well or blow-off valve?

(Question objected to by Mr. Wallace.)

A. It affects the circulation. I am not aware that it affects the blow-off valve in the least. It facilitates the circulation of the fluid through the straw.

Q. Then it was an improvement on this boiler XXXX?

A. It was an improvement made for the purpose of cooking straw over the boiler marked XXXX for the cooking of wood. They were never considered essential in the bottom screens for the cooking of wood.

Q. What became of the four boilers originally built in 1859 by Stanhope like Exhibit XXXX?

A. One of them at the present time is set and in service at Royer's Ford; another is under repair at Stanhope's; and two of them laying on the ground.

Q. When were they removed?

A. A few months ago; all four. The boilers, with repair, could be used regularly in our business now.

Q. How long have you been making book-paper entirely out of wood pulp for sale?

A. As near as I can judge, we have made it since 1856, at different periods since we first commenced operations, without the admixture of any rags. There have been books printed on it, in 1856 or 1857. T. B. Peterson printed books on it. It was sold through Syl. Magarge.

Q. How long have you been working paper entirely out of wood, equal to the samples produced by you?

A. That is a question of judgment on the part of the consumer. Smith & Peters pronounced paper made entirely from wood, which they had from us in 1856, better than any they have ever had from us since. This paper was made at Royer's Ford, in 1856.

Q. Is that the first book-paper you made of all wood?

A. I cant't fix any date for that. On reflection, however, I can go back to 1854—pulp made at Gray's Ferry.

Q. What is the lowest pressure at which you have made good paper out of wood; and when did you make it at that lowest pressure?

(Mr. Wallace objects to the question.)

435 A. I never experimented at the lowest pressure, as my work was always conducted at a safe business working-pressure to produce good results. I have usually employed 140 to 160 pounds.

Q. At what pressure were the specimens made?

A. At from 140 to 160 pounds.

Q. What do you mean, in your last but one answer, by a safe business working-pressure?

A. To get at positive and certain good results in the shortest time.

Q. From whom did you learn that from 140 to 160 pounds pressure was a good "safe business working-pressure," and how long have you known that?

A. All the work, in our early stages of manufacture, was conducted in the presence of Mr. Burgess, and experience taught us that good results always were attained by those pressures. I learned it from Mr. Burgess, and we have samples made at a pressure of 140, made in 1854. The first pressure-boiler we ever had was made under the instructions of Mr. Burgess, which boiler was used at Gray's Ferry in 1854.

Q. Were not your first operations at Gray's Ferry conducted in an open vessel?

A. We never made any experiments in an open vessel?

Q. Had you any knowledge of any operations in making pulp from wood by boiling it in dilute alkali of about the strength of 12 degrees English; then subjecting it to chlorine gas, and then to a warm solution of dilute alkali, until it pulped, prior to bleaching it?

A. My only experience has been in connexion with the pressure-boiler alluded to, and in which the material was pulped in the first instance. Such material, when of resinous wood, was submitted to the alternating processes alluded to, to more thoroughly cleanse and purify it of all coloring matter, prior to bleaching. I frequently use the alternating processes alluded to by Mr. Harding, at different periods, from the early to the present manufacture, and frequently resorting to it to obtain a good color from resinous woods.

Q. In all the operations as practised by you since 1854, have you succeeded in pulping wood by boiling it in caustic alkali, under pressure, without the aid of chlorine?

436 A. I have.

Q. You resort to the alterating process to improve the color?

A. We do. Any boilers that might be imperfectly pulped would be finished by that alternating process. I might remark that you can get from 33 to 50 per cent. of pulp out of the wood, according to the perfection of the pulping operation.

Q. Please examine the annexed Exhibit XXXXX, H. P., jr., and say whether it is correct?

A. I have examined it and it is correct.

Q. You used no other digesting boilers than those bought of Stanhope after 1859?

A. We may have used others as auxiliaries. We used the 4 boilers exclusively after we began cooking wood, after 1860.

Q. In your former testimony, Dixon vs. Keen, taken in 1866, January, you were asked "What is the lowest pressure at which you have worked those boilers with wood without burning, and what with straw?"

and you answered: "That comes to near an exposure of our process of manipulation, and I decline to answer the question. I would add that no man, in our employ for the last ten years, knows at what pressure." Is that correct?

(A copy of the witness' testimony is offered to him to refresh his memory.)

A. That is correct. No man in our employ knew at what pressure we worked, and don't know to-day.

Q. Did you ever make, or knew made a merchantable pulp by boiling wood in caustic alkali at a temperature of three hundred degrees, (300°;) and if so, when, and by whom, did you first know it to be made?

A. I have never worked at the minimum temperature that would produce that pulp. I have always worked at higher pressures to produce quicker results. I have known the temperature vary with the same pressure. I decline to say what temperature corresponds to a given pressure without consulting books and tables, as they vary according to the strength of the solution. I cannot definitely say whether I ever made it myself at that temperature. I can't answer as to whether I ever knew it to be made by others at that temperature or not.

437 JUNE 29TH, 1867. Present H. E. Wallace, attorney for complainants.

MORRIS L. KEEN appears pursuant to the original notice served in this case.

Mr. Wallace, for complainants, adopts the testimony as taken June 27th, 1867, by agreement with Mr. Harding and for the accommodation of Mr. Harding, and recalls Mr. Keen.

Q. Please to look at the tracing shown you. (Being shown Exhibit Y, Keen, H. P., jr.) State whether you understand this drawing as representing a boiler and differing in construction from your boiler under the patent of 1863, and wherein do you observe that difference?

A. I do understand it as the representation of a boiler. The difference appears to be merely in the locality of the man-head for charging the boiler which is placed below the screw or the diaphragm.

Q. State whether a boiler constructed in this manner contains the elements of your boiler under your patent of 1863, and is the principle varied in any respect by the different locality of the man-head?

A. The boiler contains all the principles and elements of my boiler under my patent of 1863. The principle of working is not in the least varied by the locality of the man-head. The effect of the operation is precisely the same in both cases.

MORRIS L. KEEN.

Sworn and subscribed this 29th day of June, A. D. 1867, before me.

HENRY PHILLIPS, JR.,
N. Y. Commissioner.

Harding annexes—
Exhibit XX, Keen.
A copy of Keen's patent, Dec., 1863.
Ex. XXX, Keen, drawing Keen boiler, 59.
" XXXX," " " " 63.
" XXXXX, " printed copy of record-book of Hugh Burgess.

438 EXHIBIT (C. M.)

Decision of the Commissioner of Patents.—Application of Watt & Burgess.—Improvement in making paper.

The applicant proposes to make paper from woody fibre by treating it in a certain manner. Chemists have before shown, that by treating woody fibre in a manner not widely dissimilar to that pointed out by the applicant, a substance, which is termed cellulose is obtained. It was also known that cellulose constitutes, in an almost pure state, the substance of which paper has heretofore been made. Under these circumstances it has been thought that the making of paper in the manner pointed out by the applicant, was not patentable; but it is one thing to ascertain a scientific fact, and it is another and a very different thing to subjugate that fact to the common every-day purposes of life. The latter is patentable; the former not. Can it be possible that a pine-plank can be formed into a ream of paper without including a patentable discovery in the process by which that end is attained?

Now the chemist who merely separates the cellulose from the other ingredients of the wood cannot stop there and obtain a patent for his discovery.

In order to claim such a patent he must show some practical benefit that will result from it. The benefits of the patent law are entirely intended for the practical man.

The man of science makes the great discoveries which the prac-
439 tical man turns to account. The labor of the former may be far the most meritorious. The latter is the only one for whom a pecuniary recompense is provided.

In the case of making paper from wood, if the present applicant cannot obtain the patent no one can.

This of itself would seem sufficient reason for granting the patent.

But by changing our point of view, we shall see the reason of this more clearly. Science had ascertained that cellulose could be obtained from wood, in substance, the same as the fibre of flax or cotton. If, now, some one should contrive a means of transforming this cellulose into a substance that could be spun and woven into strong and durable cloth, does any one doubt of the patentability of the discovery? The making of paper would seem almost equally so. Again, the discoveries of the chemist are irrespective of expense. Whether the means used can ever be employed practically in constructing any material from cellulose for common use, is wholly unknown, so far as anything has been ascertained from him.

The pointing out a practicable mode of producing cullulose from wood in a manner requiring so little labor and expense as to cause its adoption in the useful arts, involves a patentable discovery.

A patent will therefore be granted.

C. MASON.

440 *M. A. C. Mellier's patent of May 26, 1857.—Petition, correspondence, &c., from the records of the United States Patent-Office.*

To all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the files of this office of the file-wrapper and contents, in re, the letters-patent granted M. A. Cha's Mellier, May 26, 1857, No. 17387.

In testimony whereof I, T. C. Theaker, Commissioner of Patents,

{ SEAL OF THE PATENT-OFFICE OF THE UNITED STATES OF AMERICA. } have caused the seal of the Patent-Office to be hereunto affixed this first day of November, in the year of our Lord one thousand eight hundred and sixty-seven, and of the Independence of the United States the ninety-second.

(Signed) T. C. THEAKER.

NEW YORK, *September* 30, 1856.

To the honorable the Commissioner of Patents:

SIR: I send you the papers, model, and power of attorney relating to A. Mellier's application for a patent, and I claim for it the privilege granted by law of an immediate examination.

Foreign patents have been granted to A. Mellier, in France, in the name of Ladet, August 7, 1854; in England, in A. Mellier's name, May 2, 1855, and sealed October 26, 1855.

441 I send you the papers received from France, which I have reason to believe to be a copy of the English patent; and of also a new specification and drawing, which I wish to substitute to the first. I hope you will find them drawn more in accordance with the directions of your office.

Respectfully yours,

V. BEAUMONT.

96 WALKER STREET.

(Endorsed:) Received and filed October 3, 1856. L. F. W. 3751—1.

To the Commissioner of Patents:

The petition of Marie Amidée Charles Mellier, of Paris, in the empire of France, respectfully represents:

That your petitioner has invented an improvement in the manufacture of paper, which he verily believes has not been known or used prior to the invention thereof by your petitioner. He therefore prays that letters-patent of the United States may be granted to him therefor, vesting in him and his legal representatives the exclusive right to the same, upon the terms and conditions expressed in the act of Congress in that case made and provided, he having paid three hundred dollars into the Treasury and complied with other provisions of the same act.

And he hereby authorizes Victor Beaumont, of New York City, to act as his attorney in presenting this application, altering, or withdrawing the same, as the case may require, and to receive the patent when granted.

LONDON, *July the* 21*st*, 1856.

AM. MELLIER.

LONDON, COUNTY OF MIDDLESEX, ENGLAND.

On this 22d day of July, 1856, before the subscriber, consul of the United States, personally appeared the within-named Marie Amidée Charles Mellier, and made solemn oath that he verily believes himself to be the original and first inventor of the improvements in the manufacture of paper, herein described; and that he does not know or believe the same was ever before known or used; and that he is a citizen of France.

AM. MELLIER.

442 CONSULATE OF THE UNITED STATES OF AMERICA, LONDON.

I, Robert P. Campbell, consul of the United States of America for London and the dependencies thereof, do hereby make known and certify that, on the day of the date hereof, before me, personally appeared and came Marie Amidèe Charles Mellier, who subscribed the foregoing affidavit in my presence, and then and there made solemn oath to the truth thereof.

In testimony whereof I have hereunto set my hand and affixed my seal of office, in London, this twenty-second day of July A. D. 1856, and in the eighty-first year of the Independence of the said United States.

[CONSULAR SEAL.] ROBERT P. CAMPBELL.

(Endorsed:) Received and filed October 3, 1856. L. F. W.

To all whom it may concern:

Be it known that I, Marie Amidée Charles Mellier, of Paris, in the empire of France, have made an invention for an improvement in the manufacture of paper, and I do hereby declare that the following is a full and exact description:

The invention has for its object a peculiar process for the treating of straw and other vegetable fibrous materials requiring like treatment preparatory to the use of such fibres in the manufacture of paper; and the improvement consists in subjecting straw or such other fibrous materials to a pressure of at least seventy pounds on the square inch when boiling such fibrous matters in a solution of caustic alkali. For this purpose the straw or fibrous matters are cut into short lengths, soaked in warm water, and washed. They are then placed in a suitable boiler, and I use for such purpose a rotary boiler provided with a coil or coils of steam-pipe, for the purpose of heating the contents; and I prefer that the boiling should be carried on at a temperature to produce at or about eighty pounds on the square inch in the boiler where are the fibrous materials to be acted upon. But so high a temperature is not absolutely necessary, for I have found by experiment that it is essential that a temperature equivalent to seventy pounds on the square inch must be employed. The quantity of alkali used is at the rate of
443 about 16 per cent. of caustic soda or potash of the straw or fibrous substance under process. The fibres may then be bleached by the use of a comparatively small quantity of bleaching-powder or chloride of lime.

To enable others skilled in the art to make and use my invention, I will proceed to describe more fully the manner of using the same.

The straw or other fibrous material requiring a like process to prepare the same for the paper-manufacturer is, first, as heretofore, to be cut in a chaff-cutting or other machine into short lengths, and to be freed from knots, dirt, and dust, and then steeped for a few hours in hot water. The straw or fibrous materials and a weak solution of caustic alkali are then to be placed in a suitable close boiler, heated by steam, as hereafter explained, and the heat is to be raised to such a degree as to attain and maintain for a time a pressure internally of the boiler equal to or exceeding seventy pounds on the square inch, that is, about 310° of Fahrenheit, by which means a considerable saving of alkali, as well as time and full results, as compared with the means of using a hot solution of caustic alkali, as now practised in preparing straw and other fibres for paper-makers.

The boiler employed for the purpose, and the manner of heating it

by steam, may be varied; but, 1st, it must have a rotary motion either on its long or on its small axis, by means which are very well known; and, 2d, I prefer not to send the steam directly into the liquid in which the materials are immersed, but to pass it, either in a jacket around the boiler or through a coil or a system of steam-pipes inside of it, so that the steam does not mix with the caustic alkaline solution in the middle portion of the boiler, but is kept separate, and does not therefore in condensing dilute the caustic alkaline solution used.

The plan of construction of the boiler I should recommend would be, if the boiler is to rotate vertically or on its small axis, as very well known, to cover it with a jacket, so that the steam could circulate from one end to the other between the two plates; or rather, if it is to revolve horizontally, or upon its long axis, as is equally very well known, to fix near each end of the boiler, and inside of it, a diaphragm or partition, which partitions are connected together by numerous tubes, which are arranged in a circle near the outer circumference of each partition. By this arrangement the steam is introduced through
444 the hollow axis at one end of the boiler, and it passes through the steam-pipes, and thence into the compartments at the other end of the boiler, where it and the condensed steam is conveyed away, as is well understood, through the other hollow axis. In adopting the plan of not sending directly the steam into the boiler, I found the three following advantages:

1st. Not to dilute, as I have already said, the alkaline solution; 2dly. To avoid the trouble of having sometimes the end of the steam-pipe in the boiler choked with straw, and to prevent, in case that by one cause or another the pressure in the steam-boiler would fall under the degree of the pressure in the straw-boiler, the priming of the first by the second, viz., the absorption of straw and alkaline solution from the straw boiler into the steam boiler; 3dly. The greater facility of cooling the straw boiler when the pressure has been maintained for a sufficient length of time by means of turning off the steam at one end, letting it at the other end out of the jacket or of the coils or steam-pipes just described, and getting through the same a stream of cold water, which at the same time that it cools the mass furnishes a quantity of cold water which can be received in convenient vessels, and will be found very useful for washing the straw or other fibrous material after boiling.

By means of submitting the straw or other fibrous materials to a pressure of between seventy to eighty-four pounds on the square inch inside of the boiler I can reduce considerably the proportion of alkali, and the solution which I prefer to use is to be from two to three degrees of Beaumé or of a specific gravity of from 1.013 to 1.020, and at the rate of about seventy gallons of such solution to each cwt. of straw or other fibrous vegetable matters requiring like treatment.

The boiler is to be filled with straw and alkaline solution, and then closed fluid and steam tight. The boiler is made to revolve slowly, say about one or two revolutions per minute, and the steam is to be admitted. I find it desirable to keep up the heat and pressure during about three hours after the pressure above-mentioned has been obtained, when the process of boiling is complete. A steam-gauge properly fixed upon the boiler will enable one to ascertain when the pressure has obtained the required degree.

When the apparatus and the fibres under process has been cooled by the means hereinbefore mentioned, or rather when the
445 pressure has been reduced to nothing, I open the man-hole of the boiler, empty the materials in suitable vessels, and wash them

first with hot water, then with cold water, until the liquor runs perfectly clear. I then steep the fibres for about an hour in hot water acidulated with a quantity of sulphuric acid equal to about two per cent of the weight of the fibres under process, and finally the washing is completed with cold water. The straw or fibre may then be bleached in the ordinary manner, and it will be found to be accomplished by a comparatively small quantity of chloride of lime.

Having thus described the nature of my said invention and the manner of performing the same, I would have it understood that I do not claim the general use of caustic alkaline solutions, nor the employment generally of a close boiler for boiling straw or other vegetable fibrous substances.

But what I claim is, the subjecting straw or other vegetable fibrous substances to a boiling process in a weak solution of caustic alkali under considerable pressure, such as herein described.

AM. MELLIER.

Witnesses—
ALLERENE.
E. MARZI.

Received and filed October 3d, 1856.
L. F. W. 3751.

9TH OCTOBER, 1856.

Upon comparing the specification of your application for patent for the manufacture of paper, as originally drawn up by you in Paris, with that prepared by your attorney in New York, it appears that the alleged inventions described and claimed in the respective specifications are not identical. The oath annexed to your original specification would therefore not apply to your amended specification, which is consequently returned for the supply of this deficiency.

Lest, however, you should by this point of formality be induced into error as to the light in which your two specifications are considered by this office, you are further informed that your original specification is drawn up in full accordance with the rules of this office, and may,
446 if so expressly desired by you, upon return of the papers, be examined at once for the final decisions of your application. Should you, however, desire to have your case examined upon the specification herewith returned, there would, beyond the formality of an oath, be necessary also, although a division of subjects, the process embraced by your first claim constituting one, and the boiler embraced by your second claim constituting another distinct subject of patentability, and which could not be claimed under one and the same fee.

M. A. CHA'S MELLIER,
(Care of V. Beaumont, No. 96 Walker street, New York.)

(Endorsed:) Office to Charles Miller. 9th October, 1856. 3751—2.

To the honorable the Commissioner of Patents.

SIR: Mr. Mellier's interest is to have his invention decided upon as soon as possible; in consequence, I wish you to examine at once, as offered, the original specification.

The second specification, after striking out claim No. 2, is meant to

be a more complete description than the first. Please tell me if it will be kept in your records.

Respectfully, yours,

V. BEAUMONT,
96 *Walker.*

I should like to be enlightened on one point: if I had stood by the second specification, who was to take the oath required, Mr. Mellier, who is in England, or I?

I here return the papers.

(Endorsed:) M. A. Ch's Mellier to office. Filed 15 Oct., '56. 3751—7.

OCTOBER, 1856.

In answer to yours of the 10th inst., you are informed that your application for letters-patent, for alleged improvement in the manufacture of paper, will be examined forthwith upon your original specification. The second specification, unless requested by you otherwise, will remain on file in the office.

447

If you had stood by the second specification, the oath would have to be taken by you personally, in England, as there is no law in patent cases, making an exception from the common law, that oath cannot be made by attorney.

M. A. CHA'S MELLIER,
(Care of V. Beaumont, No. 96 Walker street, N. Y.)

(Endorsed:) Office to M. A. C. Mellier. 18 Oct., '56.

U. S. PATENT-OFFICE, 22*d Oct.*, 1856.

SIR: The claim of your application for a patent for alleged improvement in preparing paper-pulp from straw or its equivalent, has been duly examined, and, for reasons and reference given, the claim is refused.

The patent of Geo. Spofford, for a rag-boiler, granted in 1840, and reissued in 1850, extended to 1854, covers nearly the whole body of your claim, as you will perceive on inspection. So far as perceived, there is nothing left for you but the use of the alkaline solution, provided with or contained in a compartment separate from that which conveys the steam-heat. If you choose to amend so as to restrict yourself to such devices, and they prove to be new, then such claim may be admitted,

The specification is returned herewith for your further action.

Respectfully,

M. C. MELLIER,
(Care of V. Beaumont, 96 Wall street, New York.)

(Endorsed:) Office to Mellier, 22d October, 1856. 3751—5.

448 To all whom it may concern:

Be it known that I, Marie Amidée Charles Mellier, of Paris, in the empire of France, have made an improvement in the manufacture of paper, and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

My improvement has for its object the treating of straw and other vegetable fibrous materials preparatory to the use of such fibres in the manufacture of paper, and it consists in boiling said substances in a solution of caustic soda, under considerable pressure.

To enable others skilled in the art, to make use of my invention, I will proceed to describe its construction and operation. The straw or other fibrous material is first cut into short lengths of about one inch, in a chaff-cutter or other machine. 2d. It is freed from knots, dirt and dust, in a smut or other machine. 3d. It is steeped for a few hours in hot water. In the meantime a solution of caustic alkali has been prepared in the following manner: in an iron tub full of warm water a quantity of lime is thrown, and the mixture is stirred so as to make the water dissolve the lime; then carbonate of soda, placed in a wire-basket is plunged into the solution of lime, and is moved in it. The effect, according to the law of Bertholet, is that the carbonic acid of the carbonate of soda leaves the soda and combines with the lime, forming a carbonate of lime that precipitates to the bottom of the tub, when caustic soda remains dissolved in the water. After allowing time for the mixture to settle, the clear solution of caustic soda is decanted, by means of a syphon, into another vessel, and the carbonate of lime is thrown away, or may be revived by burning for another operation.

The theoretical formula of the operation is: $CaO+CO2\ NaO+HO=CO2, CaO+NaO+HO$.

The proportions for the manufacture are one hundred pounds of lime for two hundred pounds of carbonate of soda; the quantity of water in the tub is indifferent, since when the caustic solution is made, it is brought to the proper degree by adding water. The degree which I prefer is from two to three Beaumé's areometer, and at the rate of sixty-two gallons of such solution for every one-hundred pounds of straw or other fibrous substances, which is equivalent to sixteen of soda
449 for a hundred of straw. Much care must be taken in preparing this solution, to precipitate the whole of the lime, as a very small quantity of the last-named substance mixed with the liquor is sufficient to render the bleaching impracticable.

The fourth operation is to take the straw from the water and to place it with a weak solution of caustic alkali in a closed boiler made in such a manner that the contents may be heated. The heat is then raised to 310 Fahrenheit or more, and the boiling is continued for three hours at that temperature. It will be known that the right temperature has been reached when a steam-gauge attached to the boiler will indicate a pressure of seventy to eighty pounds inside the boiler.

The boiler which I prefer is the one represented in the drawing. It consists of an ordinary rotary boiler modified as follows:

Two steam-chambers, one at each end, are separated from the centre part of the boiler, by partitions A B and C D, and these steam-chambers are made to communicate by steam-pipes F G, F′ G′, &c., running through the boiler. A standing pipe, H I, is made to reach the lowest point of one of the steam-chambers, and through it the water produced by the condensation of the steam is pressed out. When the boiler has been filled with straw and the solution of caustic soda, the man-holes are closed, steam is let in through journal K, and the boiler is made to revolve slowly in the usual way.

The steam introduced, will, by condensing in the pipes F G, heat the mixture inside the boiler, and the opening of pipe H I will be regulated by a cock, so as to let the water of condensation out and not the steam.

The fifth operation is to cool the fibres, to wash them and to free them entirely from the alkali. The cooling is done by making a stream of water run through the pipes F G instead of steam, thus procuring at the same time a supply of clear water. The washing is done by emptying the fibres into a drainer and pouring on it first warm water, then cold water, till it runs out clear; said washing could also be made in the boiler itself. To free the fibres from alkali, they are steeped one hour in hot water, acidulated with a quantity of sulphuric acid equal to about two to three per cent. of the weight of the fibres, and finally they are washed with cold water. The fibres are then ready to be bleached in the usual way, and it will be found to be accomplished by a
450 comparatively small quantity of chloride of lime, that is to say, less than one-half the quantity usually required. Besides reducing largely by this new process of treating straw the quantity of chemicals, I find also a saving of sixty-six per cent. on fuel, of twenty per cent. on labor, and of twenty-five per cent. on the cost of the apparatus.

Having thus described my invention I wish it to be understood that I do not confine myself to the numbers mentioneed or to the apparatus described. I have found that the degree of solution, the quantity of solution, the temperature at which it is used, and the time during which it is applied are bound together in such a way that a saving on one may be made at the expense of the others. For example, if sixty gallons of solution at three degrees for a hundred pounds of straw produced a good result, a quantity of ninety gallons of solution at two degrees will give also a good result.

I have also found that a high degree and a short time will produce a paper less soft and pliable than the reverse; consequently the degree of the liquor, its temperature, quantity, and time of action will have to be slightly varied according to the quality of the materials acted upon and that of the paper wanted.

It is also clear that the more the fibres are manipulated before boiling, the more easy that operation is performed, and that if straw was softened by exposure in the fields or other processes, less soda would be required for boiling; and finally, though I have adopted the plan of boiling in a rotary boiler, modified as described, I know that it may be done by other arrangements.

A worm in a rotary boiler would be a good substitute for my pipes and partitions, when the rotary boiler is already built.

I could use an ordinary boiler, and send steam directly into the mixture. This plan, weakening the liquid, is not as good as the process described, but nevertheless would do. A stationery boiler over a fire could also be used, provided it is closed steam-tight, and some means of stirring be found.

Instead of pipes or a worm inside a rotary boiler, a jacket could be put outside, and steam introduced between it and the boiler.

I do not claim the use of caustic soda or potash free from any
451 mixture of lime, nor the boiling of fibres in a closed rotary or other closed boiler under a high pressure.

But what I claim as my invention, and desire to secure by letters-patent is—

1st. Boiling straw or other fibrous vegetable substances for the manufacture of paper in a solution of caustic soda or potash, without any admixture of lime, in a closed boiler under a high pressure; and,

2d. An improvement in the common rotary boiler, in partitioning the

ends and connecting them by pipes for the purposes of boiling, without weakening the liquors by the water arising from condensation.

A. MELLIER.

Witnesses—
P. COUVIER,
C. S. BUCHANAN.

(Endorsed:) Received and filed, October 30, 1856. Canceled 15th October, 1856.

"OCTOBER 31, 1856.

"To the Honorable Commissioner of Patents.

"SIR: Your letter of the 23d inst. having been misdirected to Wall street instead of Walker street, has reached me but yesterday.

"You refuse to admit Mellier's claim, such as it is, conflicting with that of J. Spofford. I have examined this last, and I here submit my views of the case.

"G. Spofford, in 1840, conceived the plan of a rotary boiler for boiling stuff under a high pressure, preparatory to making it into paper. It was found to give good results, and is used by paper-makers to boil their rags in the ordinary liquors, and boil straw to make straw-boards and wrapping-paper, that is, yellow stuff.

"They went on in this way till 1852. At that time a patent was issued to Coupier & Mellier to make white paper from straw. Two paper-
452 mills were built in the United States upon that plan, and ever since the Tribune, of New York, and the Philadelphia Ledger, have been printed on straw-paper, showing the commercial value of the patent.

"Notwithstanding this result, the owner of Spofford patent made no experiments on the boiling of straw in the boiler for the purpose of making white straw-paper.

"Then the thought occurred to A. Mellier to try high-pressure. He made experiments (to the cost of $5,000 and two years' labor) and found—

"1st. What pressure is most advantageous.

"2d. What is the best degree for the liquors.

"3d. What quantity of it is wanted.

"4th. What quantity of bleaching-powder is necessary to complete the operation.

"5th. What preparatory and subsequent treatment by washing, &c., are most proper.

"The result compared with Spofford's is, that neither made white paper. When Spofford did not, and compared with Coupier & Mellier's patent, it is that white paper is made by the new process at a great reduction of cost, namely, two cents a pound less.

"The result obtained is new and useful. Is not Mellier entitled to a patent for the means of obtaining it?

"I understand that Mellier has to pay a fee for using a rotary boiler, it being patented; but it seems to me that A. Mellier ought to be patented so as to prevent Spofford from using his own boiler in the manner discovered by A. Mellier.

"Subsequently to the first experiments, Mellier discovered there was an advantage in having the liquors separated from the steam used for boiling.

"This is a secondary claim to which you seem inclined to believe him entitled; but this is only accessory to the new process, and this alone

would not enable him to protect his discovery. I will be much obliged to you, sir, if you give me a hint as to the manner of claiming what belongs to A. Mellier.

453 "I understand that Spofford has discovered a boiler to boil any substance in any liquid, and is to be paid by those who use it; and that A. Mellier has discovered, that by 1st, washing straw; 2d, boiling it in fine caustic soda from two to three degrees, under pressure of seventy to eighty pounds; 3d, by washing again with acid water; 4th, by bleaching in chloride of lime at from one to one and a half dedrees, he obtains this result not obtained before, of making white paper cheaper than it was ever made.

"Would this, in substance, meet your approval as a claim for A. Mellier's process? I see in your directions that you are less stringent with inventors than with patent agents. I am not a patent agent, and claim your assistance.

"I remain, sir, respectfully yours,

"V. BEAUMONT.

"P. S. Should you grant my request, please direct to me as to what I can do as attorney, and as to what has to be done by A. Mellier himself."

96 WALKER STREET, *N. Y.*

(Endorsed:) M. A. Cha's Mellier to Office. Filed 4th October, 1856. 3751—6.

NOVEMBER 10, 1856.

To the hon. Commissioner of Patents.

SIR: I have written to you about A. Mellier's application towards the first of this month, and have as yet received no answer. I hope the letter has not miscarried.

I send back A Mellier's specification, which may be necessary for your answering me.

Respectfully yours,

V. BEAUMONT.

(Endorsed:) M. A. Cha's Mellier to Office. Filed 13th November, 1856. 3751—8.

U. S. PATENT-OFFICE, *Nov.*, 1856.

SIR: In reply to your letter of 31 Oct. last, in relation to your

454 process for treating straw for paper-pulp, I have to state that the office made a careful examination of your case, and gave you the best directions it could to enable you to get all that you are entitled to in the premises. If you do not approve of this, then you should employ counsel, or be your own counsellor. The office cannot afford time to give you the detail of the present state of the art of treating paper-pulp stuff in the crude state. You can amend as required, or take such other course as your wisdom may dictate in the premises.

Respectfully,

M. A. C. MELLIER,
(Care of V. Beaumont, esq., 96 Walker street, New York.

(Endorsed:) Office to M. A. C. Mellier. 11th November, 1856. 3751—7.

NOVEMBER 1856.

In answer to yours of the 10th inst., you are referred to the official letter of the day next following. Your specification is herewith again returned to you to enable you to amend the same as suggested.

M. A. CHARLES MELLIER,
(Care of V. Beaumont, 96 Walker street, New York.)

(Endorsed:) Office to M. A. C. Mellier. 14th November, 1856. 3751—9.

EVERETT & POLLAK,
American and Foreign Patent Agency,
No. 476 Seventh Street, Opposite the Post Office,
Washington, D. C.

Filed 22d December, 1856.

I hereby amend my specification of imp't in the manufacture of paper, by erasing the claim and substituting the following:

"But what I claim as my invention, and desire to secure by
455 letters-patent, is: The use of a solution of caustic soda (NaO) in a compartment of a rotary vessel separate from that which contains the steam-heat, substantially as described.

I also claim the within-described process for bleaching straw, consisting in boiling it in a solution of pure caustic soda (NaO) from 2° to 3° Beaumé, at a temperature not less than 310° Fahrenheit, after it has been soaked and cleaned and before submitting it to the action of a solution of chloride of lime from 1 to 1½ degrees, substantially as described."

A. MELLIER,
200.] By his attorney V. BEAUMONT.

PATENT-OFFICE, 26*th Dec.*, 1856.

SIR: Your specification is returned to you herewith for amendment. Treating vegetable fibre of almost every kind known by alkaline solutions has been familiarly known to paper-pulp makers since the experiments of Lady Moira, in the last century.

In a patent granted you in August, 1853, you laid claim to have made the discovery that treating straw and other materials as set forth, (at 8° to 10° Beaumé,) was a great novelty. The office allowed you a very liberal claim. You now come again and ignore the principle you then assumed, and claim just the reverse, that is, a very weak alkaline solution. More than twenty applications for treating fibre with alkali of various strengths and in varied ways have been made since your last patent, and five-sixths of all these have been permanently refused, and most of them withdrawn.

This office has taken some extra trouble to examine your case and to show you what you might, as it believes, legitimately claim. Instead of accepting it, you have made an additional claim, that would be worthless if granted you, because it would be complicated with devices already before the office.

No specific strength of alkaline solution such as you have named can be allowed you, nor any degree of heat or pressure of boiler.

Had you taken the claim given you in the words of the official letter of Oct. 22, 1856, it would have been a broader and equally

456 safe claim with that you have proposed, as your own good sense would show you by carefully comparing the two.

The second claim must be cancelled before the first can be admitted.

Respectfully,

M. A. C. MELLIER,
V. BEAUMONT,
96 *Wall Street, New York.*

(Endorsed :) Office to Mellier. 24th Dec., 1856.

WASHINGTON, *April* 15, 1857.

To the Commissioner of Patents.

SIR: In reply to your letter of Dec. 24, 1856, I have to say that, after five years laborious study, and after numerous and expensive experiments, I have succeeded to invent a new process, subject-matter of my second claim of my specification of improvements in the manufacture of paper from straw, and I am happy to say that my efforts were crowned with success. Several paper-mills in France, England, Ireland, and America are about to be or have been established, operating after the process described and claimed, whereby paper is manufactured at a greatly reduced price. From this declaration usefulness cannot be contested, and as to novelty there can be no shadow of a doubt. There must be some cause for manufacturing paper for less than two-thirds the cost than by the old process. Now what is the cause? The general use of caustic alkali is well known, but what is unknown is to use it at a certain degree of concentration (from 2 to 3° Beaume) in connection with a temperature not less than 310° Fahrenheit. I am so aware of the importance of my improvement that, with all due regard to the opinion of the office, I am bound to decline to amend the claims as suggested.

Very respectfully, yours,

A. C. MELLIER.
By his attorney, V. BEAUMONT.

(Endorsed:) Filed April 16th, 1857. Mellier to office.

457 U. S. PATENT-OFFICE, 18*th April*, 1857.

M. A. C. MELLIER, (care of V. Beaumont.)

SIR: The claims of your paper-pulp process have been examined.

The first claim is admitted as it stands. The second claim is refused on the patent of Lemuel Wright, of 27th March, 1847.

Wright used the caustic alkaline liquid at 2° to 4° Beaumé, after the material had been cleaned by the lime-water process, under the heat of high-pressure steam, and previous to being treated with the chloride of lime. If you cho'se to cancel claim 2, the specification returned herewith will give you the opportunity.

Respectfully,

(Endorsed:) Patent-Office to M. A. C. Mellier. 18th April, 1857
3751—13.

WASHINGTON, *April* 18, 1857.

To the Commissioner of Patents.

SIR: After corresponding with the office for several months without much progress, I have come to this city for the sole purpose of hurry-

ing Mellier's application for a patent, and it has taken me a full week to obtain from the office a letter which is not a decision. These delays have already been very injurious to Mellier's interest, and as I, his attorney, cannot remain any longer in this city and as I moreover do not intend to change a word in the claims, I request you to recognize Messrs. Everett & Pollak as my duly authorized counsels in this matter, and also to direct all correspondence to them.

I hereby ratify any of their actions in this case.

Very respectfully, yours,

V. BEAUMONT,
Attorney for A. Mellier.

(Endorsed on face:) Filed April 21, 1857.

458 WASHINGTON, *April* 20, 1857.

To the Commissioner of Patents.

SIR: Your letter of April 18th is received. Your reference and argument against the second claim of Mr. Mellier's application is deemed insufficient to induce the applicant or his attorney to withdraw or cancel the said claim. We will therefore consider this action as the first rejection, and now we respectfully request your consideration of the case without requiring the renewal of the oath, (Mr. Mellier being in Europe.) We are, however, authorized to give you the declaration that the applicant relinquishes the right of withdrawing two-thirds of the fee paid in the office after your complying with our request.

Very respectfully,

EVERETT & POLLOK,
Counsels for M. Mellier.

(Endorsed on face:) Filed April 21, 1857.

WASHINGTON, *April* 21, 1857.

To the Commissioner of Patents.)

SIR: Yours of the 21st inst. is at hand. You tell me to furnish the reasons why, and my doing it will make further action about relinquishing the withdrawal fee, &c., unnecessary for the present.

I have left with Mr. Pollak yours of the 18th inst., and my notes on Wright's patent. I cannot accordingly be positive as to dates and numbers.

I do not consider the reference of the office of the 18th as sufficient for refusing to grant us a patent for the reasons included in the following narrative:

Shortly after Mr. Wright obtained a patent for manufacturing paper from straw, he went to France (Normandy) and sold his French patent to a company. A. Mellier was appointed superintendent; a large mill was built, but the process failed entirely. Modifications were tried at great expense and finally the directors decided to have nothing more to do with straw. Mr. Mellier, who had become interested in this subject, left his situation and proceeded with experiments at his own expense till he succeeded in discovering his first process patented as Coupier &
459 Mellier. The Philadelphia Ledger and the N. Y. Daily Times are printed on paper made in this manner.

The process now submitted to you is an improvement on the last. To part of the soda the effect of a very high temperature is substituted which is a first saving. The result is a stuff that can be bleached with

less chloride, which is a second saving. Less time and less labor are necessary, which form another gain.

The same reason why Coupier & Mellier's process is different from Wright's are good to show that the new process is different also, and that both in relation to Wright's are new and useful.

White straw-paper cannot be made by Wright's process. When straw has been acted upon with lime no amount of soda or soda and heat and of chloride of lime, that will not eat up the fibres is sufficient to bleach it. Lime and soda are both alkali and both loosen the fibres of straw, but (a fact discovered by A. Meiller) when soda makes also the coloring matter loose lime makes it fast.

In Mellier's process the straw is soaked in water, boiled in caustic soda, washed and bleached altogether twenty-four hours.

In Wright's process twenty operations are necessary, which, added together, make about sixty hours. Mellier's makes half-stuff for the beating-engine. Wright's makes pulp ready for the machine. Mellier's makes now in England, in two mills, what is stated in his specification.

Wright never did and never will apply his process, because it is contrary to the law of chemistry.

The history of this manufacture is—

1. Making yellow paper from straw by boiling in lime-water in open vessels; no possibility of bleaching. This process is the same to this day.

2. Wright's invention substituting soda to part of the lime in closed vessels make bleaching possible, but at a great expense of fibres eaten up and of chemicals left alone as not paying.

3. Coupier and Mellier's substituting caustic soda at 10°, but in small quantity to lime, carbonate of soda, in an open vessel, is a paying process, practical here, in France, England, and Ireland.

4. Mellier's new process, substituting high temperature and agitation in a rotary boiler to part of the caustic soda, has for
460 effect to make the coloring matter more loose and bleaching more easy. Substituted to C. & M. processes in two mills in England.

Respectfully, yours,

V. BEAUMONT,
96 *Walker Street, N. Y.*

(Endorsed:) M. A. C. Mellier, to office. Filed April 28, 1857.

M. A. C. MELLIER,
(Care of Victor Beaumont, 96 Walker street, New York.

U. S. PATENT-OFFICE, 21 *April*, 1857.

SIR: Your letter of the 18th instant respecting your application for a patent for paper-pulp process has been duly received, but the practice of this office will not permit two agents to bind the applicant to relinquish the withdrawal fee as a substitute for renewing the oath in cases like the present.

If, therefore, you choose to bind your client to relinquish the withdrawal fee, you can do it, but your substitutes cannot be permitted to do so.

You say the reference of the office of the 18th "is deemed insufficient." Therefore you ask a reconsideration. You should furnish the reason why the references are deemed insufficient. When you have done so, there will, perhaps, be a ground for reconsidering the action, and possibly for granting the patent.

Respectfully,

(Endorsed:) M. A. C. Mellier, office to. 21 April, 1857. 3751—15.

WASHINGTON, *April* 27, 1857.

To the Commissioner of Patents.

SIR: We have received your letter of 21st inst.; also Mr. Beau-
461 mont's reply, which we have the honor to present to you. You will please notice Mr. Beaumont's letter of 20th requesting you to correspond with us.

Very respectfully, yours,

EVERETT & POLLAK.

(Endorsed:) Filed April 28, 1857.

M. A. C. MELLIER,
(Care of Everett & Pollak.)

P. O., 28 *April*, 1857.

SIR: In reply to yours of the 24th, duly received, which comes to the office deffcient in the renewed oath *on* what is taken as its equivalent, your relinquishing the two-thirds fee on account of the withdrawal, I have to state that your case can make no progress towards completion.

In your previous letters, filed 21 April, 1857, you ask of the office a reconsideration, without giving any ground for such act. The office called on you for your reasons. You have now given your reasons, but before the office acts, you must renew the oath or relinquish the fee.

Yours,

(Endorsed:) Office to Mellier. 28 April, 1857. 3751—7.

NEW YORK, *May 2d*, 1857.

To the Commissioner of Patents.

SIR: I hereby relinquish the right to withdraw two-thirds of the amount paid by me upon A. C. Mellier's application for patent for improvement in the manufacture of paper from straw, and respectfully request that the case may be reconsidered as early as possible.

Your obedient servant,

V. BEAUMONT,
Attorney for A. C. Mellier.

462 WASHINGTON, *May* 4, 1857.

To the Commissioner of Patents.

SIR: You will please notice enclosed declaration for relinquishment of Mr. Mellier's withdrawal fee.

We have to request your early attention to this case considering that the invention has been patented abroad long ago.

Very respectfully yours,

EVERETT & POLLAK,
Attorneys for A. C. Mellier.

(Endorsed:) Mellier to office. Filed May 4, '57. L. D. G. Relinquishes withdrawal fee. 3751—18.

U. S. PATENT-OFFICE, 5 *March*, '57.

M. A. C. MELLIER,
(Care of Everett & Pollak, present.)

SIR: This office has again examined its action of 18 April on the subject of your second claim, for treating rags in pulping processes for ash

paper manufacture, and in connection with your letter, filed 21 April, '57, ($\frac{3751}{14}$) which contains your grounds of
In the reconsideration the whole question has been reviewed without finding any good reasons for changing the decision of the 18th April.

Respectfully.

(Endorsed:) Office to Mellier. 5 May, 1857. II. Rejected 2d claim. 3751—19.

WASHINGTON, *May* 11, 1857.

To the Honorable CHA'S MASON,
Commissioner of Patents.

SIR: We have to appeal from the decision of the examiner in the matter of M. C. Mellier's application for patent for improvement in the manufacture of paper-pulp from straw.

In the hope that you will give your personal attention to this
463 case, we would request to be permitted to present a verbal argument.

Very respectfully yours,

EVERETT & POLLAK,
Attorneys for M. C. Melleir.

(Endorsed:) Rec'd and referred to Comm'r, May 11, 1857. Everett & Pollak, agents.

U. S. PATENT-OFFICE, *May* 13, 1857.

SIR: In the application of M. A. C. Mellier for a patent for alleged improvements in the manufacture of paper, twice rejected and referred to me for revision, I have the honor to report that the invention consisted in subjecting straw and other such fibrous materials, to a pressure of at least seventy pounds to the square inch, when boiling in a solution of caustic alkali. The process was for the manufacture of white paper from straw, which was not well bleached by any of the known processes. Boiling under high-pressure in a weak solution of caustic alkali using a great degree of heat—about 310° Fahrenheit—it is alleged involves important economies in time as well as in the expense of manufacturing white paper from straw. After thus boiling a sufficient length of time, the straw is washed with first hot and then cold water, until the water runs clear. The straw is then steeped for an hour in hot water acidulated with suphuric acid. After which it is again washed and bleached as usual, but requiring a smaller quantity of chloride of lime than is required in bleaching after the known processes of preparation.

The first clause of the claim is admitted by the office-letter of the 18th April, 1857. The second clause is limited to the process involved in the recital of invention and the description as above stated, and is in the following words:

"I also claim the within-described process for bleaching straw, consisting in boiling it in a solution of pure caustic soda (NaO) from 2 to
3° Beaumé, at a temperature not less than 310° Fahrenheit.
464 After it has been washed and cleaned, and before submitting to the action of a solution of chloride of lime from 1 to 2½° substantially as described." This clause of the claim was refused on Wright's patent of the 27th March, 1847.

Wright's invention consists "in the novel arrangement and construction of the several parts of the machinery or apparatus employed, and

in the application of the same to the process of reducing and bleaching straw, &c., to be used in making paper, including washing the straw, grinding it into pulp, washing the pulp, boiling the pulp, and washing, and bleaching the pulp after having been boiled. In one stage of his process he boiled his pulp or straw "for about six hours in lime-water, as afore-described, mixed with an alkaline solution of specific gravity of about 2 to 4° Beaumé hydrometer per rata, according to the nature of the material to be bleached," and though this boiling is in a clean vessel, no reference is made to any particular degree of pressure. The pulp is then agitated in the ordinary solution of acid water used for bleaching, washed, and again boiled in a solution of alkali about 2 to 4° for about four hours. The pulp is again washed, agitated in a solution of chloride of lime for about two hours, brought to the boiling-point, "until the bleaching-liquor is entirely spent," again washed, and finally scoured, when it is ready for the manufacture of white paper.

It does not require a minute comparison of these two modes of manufacturing straw-paper to demonstrate that they possess, as processes, different and distinct features that must produce differences of result.

The applicant uses a weak solution of caustic soda in very small quantity in boiling his straw, and holds it comparatively a very short time under a high degree of heat and a heavy pressure, and altogether free from lime, which is alleged to tend to fix the color, and makes the production of white paper from straw almost impossible, with a proper regard to the strength of the paper-stock.

Wright, on the contrary, mixes with his lime-water in which the straw is first boiled, an alkaline solution of specified strength, 2 to 4° Beaume, but in quantity adapted to the particular material, and to the purpose for which it is used, heats it a long time, and without regard to the particular degree of pressure or temperature.

465 I am of opinion, therefore, that the reference was not apposite, and that the second clause of the claim may be allowed without a fear of affecting the patent of Wright.

Most respectfully, your obedient servant,

HENRY BALDWIN.

Hon CHA'S MASON,
Com. of Pat's.

Approved:

C. MASON, *Comm'r.*

(Endorsed:) M. A. Cha's Mellier. Report. Filed May 15, '57.

M. A. Charles Mellier, manufacture of paper. Patent allowed for reasons on file May 15th, 1857.

C. MASON, *Commissioner.*

N. B. I.

(Endorsed:) Rec'd, and filed, May 15, 1857.

CAVEAT.

3751. No. 17387.

M. A. CHARLES MELLIER,

Of Paris, County of , State of France.

MANUFACTURE OF PAPER.

Received	October 3, 1856.
Petition	" "
Affidavit	" "

Specification		"	"
2 drawings		"	"
Specimens		"	"
Model		"	"
1 cert. dep., $300		"	"
Cash			
	Examined L. D. Gale	May	15, 1857
466	2, issue. Shugert	May	15, 1857
	3, patented	"	26, "
	" in France	Aug.	7, 1854.
	" " England	Oct.	26, 1855.

Recorded vol. 77, page 607.

VICTOR BEAUMONT,
No. 96 *Wall St., New York.*

(Endorsed on side:)

Patented in France		Aug.	7, 1854.
Patented in England		May,	2, 1855.
1, report to examiner		October	7, 1856.
2, specification returned		"	9, "
3, 4, letter		"	9, "
5, returned specifications		"	23, "
6, 7, " "		Nov.	11, "
8, 9, " "		"	14, "
10, 11, returned		Dec.	24, "
12, 13, returned I., 2d claim, returned specification for amendment		April	18, 1857.
14, 15, letter to agent		"	21, "
16, 17, letter about oath		"	28, "
18, 19, rejected II., 2d claim		May	5, "
20, reported and passed by Baldwin		"	15, "

(Endorsed:) Improvement in making paper-pulp.

467 A. H. S., 7.

MM.

The wood upon which it is intended to operate by this process should first be reduced to very fine shavings; the finer the better. This may be done by any suitable machine. The shavings should then be boiled in caustic alkali of the *the* strength indicated by about 12 of the English hydrometer. This process is much better performed under pressure after the wood has been boiled for about 24 hours, (but we do not confine ourselves to this time, as it varies with the nature of the wood & amount of pressure, &c.)

468 A. H. S., 9.

Loss of water in sawdust, &c., &c.

(*a.*) Fresh from the mill, wood just out of the water, 1″=lost 6½ oz.= 40 p. cent. water.

(*e.*) 20″ sawdust, lost 9″=45 p'r cent. water.

(f^1.) 1″ of sawdust boiled to a pulp—gased & pulped=14½ oz., or a loss of=9.40 p'r cent—bleached, could detect no loss.
(f^2.) 1″ of sawdust took [unintelligible] =pulped & bleached= 14 oz.

469 A. H. S., 10.

(*h*.) 200″ of raw stock, boiled to a fair pulp, lost 132″ or 66 p'r cent.
(i^1.) 40 galls. of black alkali, 5 Be., evaporated to dryness=13″ black-ash + 4 gall's of H O=26 Be., 60°—when brought to 10 Be.=10 gall's, =10° sod'-ash.
(i_2.) Repeated the above; obtained 12″ 6 residue. There was a slight loss in the boiling this batch=20½ gall's caustic 5 Be.
(l_3.) Repeated the above with 40 gall's of alkali of 6 Be., from boiling H=19″ reduced to 10 Be.=18 ¼ gallons. There was some loss by boiling over in this experiment.
(*k*.) 2½ oz. of common rosin took 5½ oz. of caustic alkali of 15 Be. to neutralize it.

470 A. H. S., 11.

Boiling, & gas'g, Dec'b'r 7, 1854. (*A*.) *c*.

Wood, 250″ containing 40 p. cent. water.
Alkali, 70 gallons, 17 Be., 120°, contained a good deal of C O_2, boiled 9 hours to a fair pulp.
Alkali, after boiling, 11° Be., & still caustic.

471 A. H. S., 12.

Boiling, gasing, &c. (*B*.)

Wood, 250″
Alkali, 70 gall's 60°, 25 Be., much C O_2. After boiling, 11 Be, slightly caustic; the stock soft but not pulped.
Gasing, 240′ salt; stock gased red; too much gas

472 A. H. S., 13.

PAPER.

Boiling, & (*C*.)

Wood, 60″
Alkali, 20 gall's; nearly caustic; 11½ Be. 160°.
This experiment was spoilt for want of steam-pressure. Pipe burst.

473 A. H. S., 14.

PAPER.

Boiling, &c. (*D*.)

Stock, 250″
Soda, 100″ }
Lime, 100″ }
Mixed in the boiler the milk of lime & the solution of soda. The stock was boiled 14 hours; was not pulped. The solu. was but little carbonated on drawing, & still slightly caustic.

474 A. H. S., 15.

Boiling, &c. (*E.*)

Stock, 200″

Alkali, 60 gallons, 13 Be., 60°, very nearly caustic; boiled for 5 hours; stock loose, but not pulped; added 48 gall's of 8 Be.; boiled 8 hours; stock soft but not quite pulped; if blown out with a head of steam would have pulped.

120″ salt stock gased red'ish; not quite finished; boxes very cold; stock frozen.

475 A. H. S., 16.

Paper return.]

Boiling, &c. (*F.*)

Stock, 200.

Alkali, 58 gall's, 3 Be. This did hardly any good. +20 gall's of 11 Be. caustic; boiled some hours; stock soft; not pulped; solu. very slightly caustic. This was again boiled in about 50 gall's of 12 Be.; not very well pulped.

476 A. H. S., 17.

Boiling, & (*G.*)

Stock, 200″

Alkali { 40 4 Be. / 11 12 Be. }

7 Be., 51 gall's of 7 Be.; alkali came out 5 Be., & not at all caustic. +60 gall's of 13 Be.=110 @ 10¼ Be., boiled for 4 hours. This charge was boiled to a good pulp. The solu. was very caustic.

The combined alkalies=5 Be., 200 gal's.

477 A. H. S., 18.

Boiling. (*H.*)

200″ dry stock. (40 p'r cent. water in the original stock)=335 of wet stock. 60 gall's alkali, 13 Be., boiled 5 hours; stock soft; not pulped; alkali quite neutralized+60 gall's of 9 Be., boiled 4 hours; alkali neutralized+50 gall's of alkali 13 Be.; stock pulped in 8 hours; alkali very caustic=8 Be. Washing the stock in the press, & the old alkali in the stock in the boiler brought the alkali down to 6 Be.=96 gallons.

NOTE.—These 96 gall's were made up of the neutralized alkali in the stock. The condensation & the new alkali. Vid. (l_3.)

478 A. H. S., 19.

Boiling. (*I.*)

Stock, 250.

Alkali, 80 gall's of 8 Be., boiled about 2½ hours; stock very soft—alkali neutralized=6 Be.+50 gall's of 6 Be. boiled 8 hours; stock nearly pulped=alkali neutralized=4 Be.

479 (Here follows diagram marked page 479.)

Circuit court of the United States for the eastern district of New York.

THE AMERICAN WOOD-PAPER COMPANY
v.
THE FIBRE-DISINTEGRATING COMPANY.

APRIL 24TH, 1867.

Present, S. D. Law, esq., counsel for defendants, Francis C. Nye, counsel for complainants.

Testimony taken on the part of the defendants under the 67th rule of the Supreme Court of the United States.

THOMAS HOWLAND, deing duly sworn, deposeth and saith:

Int. 1. What is your name, age, residence, and occupation?

Ans. Thomas Howland; age, 64; residence, Stockport, Columbia County, New York; occupation, paper-maker.

2. Did you ever use, before the year 1853, a rotary boiler in paper-making?

A. Yes, sir; in the fall of 1852.

480 3. When and where was that boiler obtained, and what did you have to do in the getting of it?

A. I obtained it of Goddard, Rice & Co., of Worcester, Massachusetts.

4. What instructions were given by you, if any, as to what degree of pressure such boiler should be made to stand?

(Objected to.)

A. I ordered it to be made to stand 60 lbs. pressure.

5. For whom was that boiler made, and where was it to be put up, and when was it put up, and how long was it used at that place by you?

A. It was made for Beach & Howland, of Fort Edward, Washington County, and was put up in the fall of 1852, and was used by us until the 1st of May, 1853.

6. Were you one of that firm of Beach & Howland?

A. I was.

7. What did you boil in that boiler?

A. Rags, Kentucky ropes, and Kentucky bagging.

8. What steam pressure did you use in that boiler?

A. 60 pounds.

9. What kind of a boiler—that is, by what name was such a boiler as you put up there known?

A. They called them Spafford's rotary boilers.

10. Did you see any of Spafford's rotary boilers in use before you ordered that one for your mill? If so, where?

A. I think it was about three years before that I saw one at Spafford's paper-mill at Willimantic, Connecticut. There I saw it in full operation.

11. What was he boiling or what did he boil in it?

A. He was boiling rags and Kentucky rope.

12. What is Kentucky rope?

A. It is rope that is taken off from bales of cotton made of Kentucky hemp-tow. The poorest part of the hemp is the tow, full of shive.

13. When you boiled hemp, rope, and so forth, in that boiler were you and Spafford the only parties, to your knowledge, who boiled such rope in such boiler?

A. No; there were a great many other mills that were using such boilers for such purposes; so I was told.

481 (The last part of answer objected to by complainant's solicitor.)

14. Did you use such boiler or know of such boiler being used to boil cotton-waste?

(Objected to.)

A. We did not use any cotton-waste, but I have seen cotton-waste boiled in such rotary boiler.

15. What is the effect of 60 pounds pressure in boiling on the seeds of the cotton-waste, and on the shives of the hemp-rope and bagging?

A. It softens the shives and the seeds.

16. What advantage is derived from the so softening the seeds and shives?

A. So that the bleaching powders will bleach them white.

17. Look at the paper now shown you, marked Defendants' Exhibit "D," (R. G. W., ex'r,) and state whether or not the paper of that exhibit was made at Stockport, at the paper-mill of the defendants there.

A. It was made at Stockport by me, and sent to the Tribune office.

18. What was that paper made from—from what kind of pulp?

A. It was made from pulp sent from the Brooklyn works of the defendants up to me at Stockport. The pulp was made from bamboo.

19. How much did it cost per pound of paper for the bleaching liquor, with which such pulp was made into the paper, Exhibit D, was bleached?

A. One cent per pound.

20. Look at the samples now shown you, marked Defendant's Exhibits E and F, and state whether papers like those samples were made at Stockport by the defendants; and, if so, what such papers were made of.

A. They were made by the defendants at Stockport out of bamboo-pulp, which was sent up from the defendants' works at Brooklyn and made by me into paper.

21. In the manufacture from such pulp of the paper, Exhibit "E," state how the quantity of bleaching liquor used compares with the quantity of bleaching liquor required to bleach pulp from cotton rags.

482 A. About the same.

22. Have you made any paper at Chittenden & Co.'s mills, at Stockport, from cane disintegrated by Lyman's steam-blowing process? If so, when did you make it, and how did you boil the stuff, and how much alkali did you use in the manufacture?

A. I made at Chittenden and Co.'s mills, at Stockport, paper from cane so disintegrated before the war. We put in 5,000 pounds of the blown stuff into the rotary boiler. Then we put in with it 190 pounds of soda-ash and three barrels of lime, and three or four hundred gallons of water. We boiled it fifteen hours, under a pressure of 60 lbs., and from that I made the cane-paper.

23. How did that cane-paper compare with the Defendants' Exhibit E. Was it of a lighter or darker color than that, and how did it compare as to softness with that exhibit?

A. It was lighter and softer than Exhibit "E."

24. Will you produce a sample of that cane-paper made by you, marked with your name and the date April 24th, 1867, that it may be put into this case as an exhibit, to be marked as Defendants' Exhibit G.

A. I will.

Cross-examined by Mr. Nye, for complainants:

X 25. How long have you been in the employ of the Fibre-Disintegrating Company; in what capacity, and where?

A. I commenced there on 1st January, 1864, as general superintendent of the manufacturing of paper, first at Elizabethport, New Jersey, and then at Stockport, Columbia County. I have continued up to the present time.

X 26. Have the defendants manufactured any pulp for paper during your superintendency?

A. They have.

X 27. How much have you made for them?

A. I have made no pulp. I superintend the making of the pulp into paper.

X 28. How much pulp for paper have the defendants made at Stockport, and how much at Elizabethport?

483 A. They never made any at Stockport. I cannot say how much they made at Elizabethport. They made some.

X 29. How much paper have the defendants manufactured to your knowledge?

A. I cannot say.

X 30. How much short of 2,000 tons?

(Objected to.)

A. I cannot say whether short or over.

X 31. Have they kept constantly at work in the manufacture of paper since you have been at Stockport?

A. No, sir; they have not.

X 32. What proportion of the time have they been manufacturing paper there?

A. I was there about three months, and then I came to the city, and took charge of selling the paper here. While I was there I should think they were not running more than one-half the time on account of repairs and putting the mill in order.

X 33. Did the greatest quantity of paper manufactured by them at Stockport while you were there on any day exceed five tons? If not, how near did it approach that amount?

A. It did not exceed five tons. The greatest quantity was 2,800 lbs.

X 34. What was the least quantity?

A. I cannot say. I do not remember.

X 35. Did the least quantity on any working day fall below half a ton; and if so, how much, to the best of your belief?

A. It did, but I cannot say how much. We might start up and break down, and not run ten minutes.

X 36. Who has been superintendent of the mill at Stockport since you left?

A. Mr. Wallace. I think his first name is Thomas.

X 37. How much paper of the defendants' manufacture have you sold for them since you became their selling-agent?

A. I do not know.

X 38. Have you sold 1,000 tons? If not so much, state how much less, to the best of your belief.

484 A. I cannot state whether I have sold 1,000 tons or not.

Adjourned until 2 p. m., Thursday, 25th April, 1867.

APRIL 25TH, 1867.

Present, counsel for respective parties.

Cross-examination of the witness, Thomas Howland, continued:

X 39. What was the largest sale that you made as selling-agent of the defendant?

A. 103 reams of paper to the Tribune.

X 40. Have you often sold as much as that at any one time?

A. Not very often.

X 41. You never sold less than 50 reams at a time, did you?

A. I think not.

X 42. At what point between 50 and 100 reams was the average of your sale?

A. I can't say what the average would be.

X 43. Can you swear that it would not exceed 75 reams?

A. I cannot.

X 44. Did you generally sell some paper every day?

A. No, sir.

X 45. Did a week ever pass without your making any sales?

A. Yes.

X 46. Did two weeks?

A. Yes.

X 47. Did three?

A. Yes, sir.

X 48. For how many months did you act as selling-agent the defendants to sell paper of their manufacture?

A. In the neighbourho'd of a year.

X 49. To whom did you sell most of their paper?

A. To Satterlee & Lyons.

X 50. Did you sell any to any other paper-commission or jobbing-house?

485 A. Yes, sir.

X 51. Name such parties to whom you sold.

A. Vernon Brothers, Derrickson & Bartlett, Ames & Co., Bulkley, Danton & Co., and a good many others.

X 52. Did you sell any to the newspaper publishers? If so, name them?

A. The Tribune was the only one.

X 53. Did you sell all the paper of defendants' manufacture sold by them in the city of New York or elsewhere, during the period you acted as their selling-agent?

A. I did not.

X 54. Who, beside you, sold the paper of their manufacture during that period?

A. It was sold from the office No. 29 Broadway.

X 55. At what price or prices did you sell the paper of defendants' manufacture?

A. From 9 to 13 cents per pound, according to quality.

X 56. You frequently sold some paper every day in the week, did you not?

A. No, sir.

X 57. Were you paid by the defendants, as their selling-agent, by a salary or by commissions on the sales of the paper?

A. By salary.

X 58. Did you receive any commissions from the defendants for sales of paper?

A. No, sir.

X 59. Who was the owner or who worked Chittenden's mill when you made paper there just before the war?

A. The mill belonged to R. & G. Chittenden, and was worked by Chittenden & Co.

X 60. You acted as a general superintendent of that mill, did you not?

A. It was under my general superintendence as one of the firm of Chittenden & Co.

X 61. Who composed the firm of Chittenden & Co.?

A. Robert Chittenden, George Chittenden, and Thomas Howland.

X 62. For how long did Chittenden and Company work their mill in the manufacture of paper?

A. Ten years.

486 X 63. For how much of that period did they boil their material, under pressure, with soda ash and lime and water?

A. All the time.

THOMAS HOWLAND.

Subscribed and sworn before me, this 25th day of April, 1867.

KENNETH G. WHITE,
Examiner.

JOHN P. TOWNSEND, being duly affirmed on the part of the defendants, depoesth and saith:

1. What is your name, age, residence, and occupation?

A. John P. Townsend; age, 43; residence, New York City; have no occupation at present.

2. Have you been in the employ of the defendants as superintendent of their works at Red Hook, Brooklyn? If so, when and how long did you act in that capacity?

A. I acted in that capacity one year from the 1st of August, 1865.

3. Did you make paper-pulp at those works? If so, state what kind of pulp you made there during the last six months of the operations there, and from what materials such pulp was made. Was the material subjected to any and what process or processes before being treated with any chemicals?

A. We made what paper-makers term "half-stock." During the last six months I think we made some paper also; it was made some of straw and some of bamboo. The straw was not made into paper; it was only made into "half-stock."

The bamboo or straw was first put into vats and soaked. It was then put into guns, and from 165 to 170 pounds' pressure to the square inch given it, and it was then discharged into the gun-room. It was then taken and put into an open boiler, and boiled in spent alkali. It was then put into the beating-engines, washed and cleaned. It then was pumped up into a receptacle to drain; from thence into the closed boilers, and then the chemical was given it, and it was boiled under pressure.

487 4. During the last six months that you were there, after the stuff had been treated in the beating-engine, how long was it boiled in the closed boilers, under pressure, and under what pressure?

A. It was 4 hours under pressure, at a pressure not below 40 lbs. and not above 60 lbs.

5. Why or how came you to use so low a pressure as 40 lbs. to the square inch?

A. By order of the president.

6. Was it found that the upright boilers in use there, in which this stuff was boiled would not bear a pressure of 60 lbs. and for that reason among others was a less pressure used or ordered?

(Objected to form and substance.)

A. Yes; we did not deem it safe to keep 60 lbs. pressure on them.

7. Did you find that the stuff boiled was treated as effectually at 50 lbs. pressure as at 60 lbs.?

A. Yes.

8. On that fact being proved or found out, did Mr. Russell give any and what directions as to using a still lower pressure than 50 lbs.?

(Objected to.)

A. He did; he gave orders to use 40 lbs.

9. How long was that before the works at Red Hook, were closed?

A. I should say from 4 to 6 months.

10. Were these directions of Mr. Russell's followed?

A. Yes; implicitly.

11. Did you find any difference in the material whether boiled under 40 lbs. or 60 lbs. pressure?

A. There was apparently no difference.

12. What was the chemical solution in which you say you boiled the stuff and what was its strength, and what do you estimate the cost of the chemical used per pound of paper made, as you have stated during the last four to six months of the running of those works at Red Hook?

A. The solution was caustic alkali, mostly the foreign crystal. There were two classes used: Some we made on the premises. The two classes were not used at the same time. The strength would average about 12° Baumé to the pound of the dry crystal. We used 5,000° to
488 3,000 pounds of dry stock as it came from the beating-engines. As near as I can remember, the cost of the dry crystal would average about 8 cents per pound. That would be about two-thirds of a cent to a degree.

13. What do you estimate to be the quantity of paper made from 3,000 lbs. of the dry stuff treated as you have stated?

A. There is a shrinking of about 30 per cent. There would be a little over 2,000 lbs. of paper.

14. Is there a Spafford rotary boiler in the defendants' works at Brooklyn? If so, was it used to boil any of the same stuff which was boiled in the upright boilers?

A. There is such a boiler, and it was so used.

15. Did you use in that rotary boiler the same or different pressure and chemicals from that used in the upright boilers?

A. We used the same chemicals and the same pressure.

16. Is, or was there a stirrer in one of the upright boilers used there? If so, describe it, and state when such stirrer was last used?

A. There was a stirrer in both of the upright boilers. We took the stirrer out of one of the boilers from 8 to 10 months previous to the works being closed. I cannot tell exactly the time. We did not use the stirrer in the other boiler for about four months before the closing of the works. Those works were closed the 1st of August, 1866. I don't think there was any pulp made after about the 15th or 20th of July, 1866.

The stirrer was a propeller on an upright hollow shaft, extending 28 inches from the shaft. The stirrer in each boiler was made just the same.

17. Why did you discontinue the use of the stirrer?

A. We esteemed them more plague than profit.

18. How were such upright boilers loaded or charged? Was there a perforated diaphragm in such boilers, and is the man or feed hole in the boilers connected with a man or feed hole through the diaphragm by a perforated well or cylinder, so that the material can be charged through the said well into the boiler without falling upon or clogging the perforated diaphragm?

489 A. We charged them on the upper quarter. There was a perforated diaphragm situated above the man-hole plate. We charged the boiler below the diaphragm.

Adjourned until Friday 26th of April at 11 a. m.

Present.—Counsel for respective parties.

FRIDAY, *April 26th*, 1867.

Cross-examined:

X 19. What quantity of bamboo in the dry sticks was requisite to produce 3,000 lbs. of the dry stuff or stock as it came from the beating-engine?

A. It is only by estimate that I can answer that. I cannot answer that positively. I suppose there was about 40 per cent. shrinkage.

X 20. And there was a shrinkage of about 30 per cent. on the dry stuff or stock as it came from the beating-engine, in making the same into paper, was there?

A. Yes; that I made as an estimate, not carrying it through all the way into paper myself.

X 21. But to the best of your knowledge and belief, these two percentages of 40 and 30 are correct, are they?

A. I believe they are, and I think them rather above than below the amount of shrinkage.

X 22. Were the shrinkages the same during the whole of the last six months in which the mill was in operation under your superintendence?

A. There was no variation, so far as I know.

X 23. Was there any difference in respect of those shrinkages between bamboo and straw?

A. I cannot answer that question. We made none of the straw that was blown into paper. There was only a small quantity of the straw any way.

X 24. Was the shrinkage on the straw taken before cooking and cleansing, 40 per cent. making it into dry stuff or stock as it came from the beating-engine?

A. The straw was made into half-stock without going into the beating-engine at all. I do not know what the shrinkage would be, or was.

490 X 25. Was the straw put into the open boiler and boiled in spent alkali?

A. Yes.

X 26. What was then done with it?

A. It was put into the pressure-boilers and then boiled under pressure with clean alkali.

X 27. What was next done with it?

A. It was blown out of those boilers, under pressure, and washed and then removed as half-stock.

X 28. It was sent up to Stockport, Columbia County, New York, to be there manufactured by the defendants into paper, was it not?

A. I think it was.

X 29. You mean that it was sent there for that purpose when it was removed as half-stock?

A. Yes.

X 30. What quantity of straw was requisite to producee, as you treated it, a hundred weight of half-stock?

A. I don't know that I can say.

X 31. What was the shrinkage on the bamboo as discharged from the pressure-boilers in the form of pulp in manufacturing it into paper?

A. Ten per cent., I think was the estimate. I think I may say from 5 to 10. This is what I had from others.

X 32. Then shrinkage on the bamboo as dry stuff or stock in making it into pulp as discharged from the pressure-boilers, was from 20 to 25 per cent., was it?

A. Yes.

X 33. And the total shrinkage on the bamboo taken in the stick was from 52 to 55 per cent. in making it into pulp, was it?

A. From my experience I think that correct.

X 34. What was the quantity of the solution of caustic alkali of the strength of 12° Baumé to the pound of the dry crystal which you had in mind in giving the strength of solution in your answer to the 12th int?

A. We would take a pound of the dry crystal and put it into a gallon of water and it would average 12° Baumé. It would fluctuate according to the quality of the crystal. That is a fair average.

491 X 35. Then the average strength of the caustic alkaline solution which you used in the pressure-boilers, was such that a pound of the dry crystal would test 12° Baumé to the gallon of water, was it?

A. I suppose it would test higher. We did not use it as gallons but only reckon it by degrees. For instance—to 3,000 lbs. of dry stock, we put 5,000° of alkali without any reference to the number of gallons.

X 36. By dry stock, in your last answer, do you mean the bamboo as it came from the beating-engine?

A. I do. The bamboo as it came from the beating engine—dried.

X 37 What were the dimensions and capacities of the two upright boilers in which you boiled the dry stock or straw under pressure in a solution of caustic alkali?

A. I never measured them; but have been told they were 8 feet diameter and 16 feet high. I do not remember their computed capacity.

X 38. Were those two boilers so nearly alike that you could not distinguish them? If not, by what convenient designation can you or did you distinguish them?

A. I believe they were exactly alike. We designated them as No. 1 and No. 2 egg-boilers.

X 39. Did you fill to its capacity each of those boilers every time you charged them for boiling the dry stock or straw?

A. Yes; they were filled as full as we could conveniently. We intended to fill them with a uniform weight.

X 40. How many pound of the dry stock or straw did each charge of those boilers consist in?

A. I think 3,000 lbs. weight.

X 41. Do you affirm to that amount from your own unaided recollection, or do you make the statement as you find it in the report or memorandum to which you have referred?

A. I make it from my own estimate.

X 42. Then you refer to those minutes or memoranda merely to refresh your recollection, do you?

A. Yes.

X 43. And when you said yesterday in your direct examination that you used 5,000° of the caustic alkaline solution to 3,000 lbs. of dry
492 stock, as it came from the beating-engine, you had just before refreshed your memory by those minutes or memoranda, and then made that statement from your own recollection. Did you do so?

A. Yes; I referred to them as memoranda I had made at the mill daily, and I remembered I examined them. They were my records.

(The counsel for complainants here requests permission to inspect the memoranda referred to by the witness, which have been placed by him in the hands of counsel for defendants for the purpose of cross-examining the witness thereupon, which is refused by defendants' counsel.)

X 44. How many gallons of the solution of caustic alkali did each charge of these boilers consist of?

A. I do not remember. We reckoned it by degrees, not by gallons.

X 45. Do you believe there are any entries in the memoranda to which you have referred by which you might refresh your recollection, so as to be able to affirm to the approximate number of gallons?

A. I think there is in part, though we never reckoned it in that way. I always reckoned it by degrees.

X 46. State the approximate number of gallons, to the best of your belief.

A. I should think 20° Baumé to the gallon; that would make 250 gallons.

X 47. What was the foreign crystal which you used in making the solution of caustic alkali?

A. It was the ordinary crystal of commerce.

X 48. Do you mean that it is what is known to the trade as "commercial caustic soda?"

A. Yes; I do.

X 49. State the mode you used in preparing the solution of caustic alkali, as put under the pressure-boilers from the commercial caustic soda.

A. We simply dissolved it in hot water.

X 50. What did you dissolve it in, and how did you get it from that vessel to the alkali boilers?

A. I dissolved it in an iron tank, and we drew it from the tank through pipes into the boilers.

493 X 51. What were the dimensions of this iron tank, and where were the pipes fitted to it?

A. I think they were 7 feet high and 5 feet in diameter. There were two of them. The pipes were screwed into the bottom.

X 52. Were these tanks placed in an elevated position above the man-holes of the alkali-boilers, or was there a curvature in the pipes near their junction with the tanks?

A. They were placed above the man-holes. I do not think the pipes were straight. I think there were three or four elbows on them.

X 53. What was the composition of that solution of caustic alkali which you made on the premises?

A. Soda-ash and lime and water.

X 54. Were those the only components?

A. Yes.

X 55. Where did you procure the lime?

A. It was Glen Falls lime. There is a large lime district there. It is put in barrels and sent to market here.

X 56. What were the relative proportions of soda-ash and lime used by you to produce a gallon of the solution?

A. We used half as much lime as we did soda-ash.

X 57. How much soda-ash did you use?

A. We used different quantities. If we took one pound of soda-ash to the gallon of water, it would mark on the Baumé glass 10°, but I think the average, as near as my memory serves me, is 8°.

X 58. Could you refresh your recollection by referring to the memoranda referred to, so as to affirm more precisely as to the quantities and strengths and their limits?

A. I think not. It would only give numbers of degrees.

X 59. Describe the mode of preparing soda-ash, lime, and water in making the solution; the vessel in which it was made, and the mode of injection into the two alkali boilers.

A. We put in the soda-ash into iron open boilers; dissolved that by hot water; then we made the lime into a milk of lime, in a wooden vessel above the boiler in which we dissolved the soda-ash, and ran that into the boiler that had the soda-ash in it, and boiled the whole for one hour. We then drew it off, as we wanted to use it, in the
494 pressure-boilers. The open iron boilers were the same as those used with the crystal alkali.

X 60. How many degrees of the solution of caustic alkali, made from soda-ash and lime, and how many gallons of that solution did you use in each charge of the alkali-boilers.

A. We used the same number of degrees that we did of the foreign caustic crystal; but as to the gallons I cannot state their number.

X 61. What was the average strength, of the solution made from soda-ash and lime that you used, taking a gallon of the solution to a pound of the soda-ash and lime?

A. As near as I remember, it was 8 deg. Baumé as an average; sometimes it would run up to 11 deg.; the lime would not make it mark any higher on the glass.

X 62. What was the average strength of the solution of caustic alkali, made from soda-ash and lime, as injected into the alkali boilers, and between what limits would such solution range in different charges of the boilers?

A. I should think it would range from 13 deg. to 20 deg. on the glass. I cannot state the average, as it would vary. If we should put a certain number of pounds of soda-ash, to-day, in a certain number of gallons of water, it might test a number of degrees less or more than the same number of pounds and the same number of gallons would to-morrow, because of the different strengths of the soda. I always used degrees in the place of gallons, that there might be no error.

X 63. Between what limits did the solution of caustic alkali, made from the foreign crystal, range in different charges of the boiler?

A. I should say from 18 deg. to 25 deg. Baumé, one pound of crystal would vary from 9 to 19 deg. Baumé, when dissolved in a gallon of water. This variation was owing to the impurity of the crystal.

X 64. Had each of the upright boilers a perforated diaphragm?

A. Yes.

X 65. What was the purpose of this diaphragm?

A. To keep the pulp from going up the steam-inlets.

X 66. Then the boilers were heated by steam, were they?

495 A. Yes.

X 67. And the ends of the pipes through which the steam was introduced into them were above the diaphragms, were they?

A. Yes.

X 68. Was the steam introduced into these boilers directly into the expansion-chamber above the diaphragm, and did it thence exert a pressure upon the contents of the boiler, or were there pipes through which the steam was passed without its coming in actual contact with the contents of the boiler?

A. It was introduced into the top of the boiler over the diaphragm and into the boiler below the diaphragm by a separate pipe, and into the bottom of the boiler by another pipe. The steam exerted a pressure on the whole boiler from the lower pipes as well as from the upper one above the diaphragm. There were pipes through which the steam could pass, but we did not use them. There were five entrances for steam into those boilers; four below the diaphragm.

X 69. Then in practical operation the steam came from the pipes by which it was introduced into the boiler directly in contact with the contents of the boiler, except that introduced by the pipe above the diaphragm, did it?

A. Yes, it did; but frequently, I suppose, the liquor was above the diaphragm, when it was expanded into steam by the heat.

X 70. Describe the manner in which the steam was introduced into the boilers from the four lower pipes.

A. The pipes were screwed into an ordinary stuffing-box. The steam went from the lower pipes down across the cock. I think the lower inlet of the steam was 3 feet above the discharge-cock. I am speaking now of the two lower entrances—they dipped down so as to keep the mouth of the cock clear. The two lower pipes entered the boiler at the junction of the egg and upright portion of the boiler. They then curved down along the egg portion of the boiler to right over the discharge-valve. The two upper ones came in at about the same position, at the top of the boilers. They just went through the boiler.

X 71. Was steam introduced into the boilers through the
496 two lower pipes that opened over the discharge-valves during all the four hours or more of the boiling?

A. Yes, usually.

Adjourned to Saturday, 27th April, 1867, at 11 a. m.

APRIL 27TH, 1867.

Present, counsel for respective parties.

Cross-examination continued:

X 72. What was the size of these five pipes?

A. I think four of them were 1 inch in diameter, and I think one was 1¼ in diameter. Those four might not have been more than ¾ inch. The four were the four lower ones. The bore was uniform in each of the five.

X 73. At what rate or rates was the steam introduced into the boilers?

A. The boiler that we fed from usually had 65 lbs. pressure, and when we got up to our requisite pressure, which was indicated by a guage, and also by a safety-valve, we then shut off our boiler to keep the pressure below, so that the safety-valve would not raise on the pressure boiler, and opened the doors of the steam-boilers to stop their making steam, or at least only enough to keep up the pressure to 40 lbs. on the pressure-boiler.

X 74. What pressure did the steam-guage on the alkali-boilers indicate after you had got up to the requisite pressure?

A. 40 lbs.

X 75. But it varied, did it not; and if so, between what limits did it range?

A. I do not know that it varied.

X 76. State the time when you began to limit the pressure to 40 lbs., or thereabouts?

A. As near as I remember, it must have been in October or November, 1865.

X 77. But previously to that you had used a pressure that was indicated on your steam-guage by 50 lbs., had you?

497 A. For a short time. I should think not to exeeed two weeks.

X 78. And previous to the use of that pressure indicated by 50 lbs., you had used a pressure indicated by 60 lbs. on your steam-guage, had you?

A. Yes.

X 79. For how long was the pressure indicated by 60 lb. on the steam-guages attached to the alkali-boilers, used by the defendants at their mill in Brooklyn?

A. I cannot say exactly. I should think it must have been about a year, though I do not think the boilers were in constant use for that length of time.

X 80. Are there any entries of the pressures indicated by the steam-guages on the alkali-boilers, in the memoranda to which you have referred to refresh your recollection in some of your previous answers?

A. No; not that I am aware of.

X 81. Can you affirm positively that there are none?

A. Yes.

X 82. You say that they were memoranda made by you at the mill daily, and were your records. What did those memoranda relate to, and to whom do they now belong?

A. A daily record of stock used; amount of labor; what was received as tools or machinery that came into the mill, as coal that came into the mill. This is all I think of now. They are my private memoranda which I made for the mill, and are now in possession of the company. They belong to the company.

X 83. How did they come into your possession when you referred to them on your direct and cross-examination?

(Objected to, as assuming that the witness referred to such memoranda on his direct examination when it does not appear as a fact that he did.)

A. I think that they were given to me by William P. Arnold, at my request, some three months ago, and I did not refer to them or take them out during my direct examination.

X 84. Had you kept possession of them ever since you received them from Mr. Arnold?

A. Yes.

498 X 85. Is Mr. Arnold the secretary of the Fibre-Disintegrating Company, the defendants?

A. Yes.

X 86. Then they remained in your possession until you gave them to defendants' counsel after answering, cross-interogatory 43, did they?

A. Yes.

X 87. What do you mean by "stock used," in your answer to cross-interrogatory 82?

A. I mean the number of discharges of the guns; the number of discharges of the pressure-boilers; the number of degrees of alkali used; number of pounds of iron used in the blacksmith's shop; number of

pounds of coal used; the number of pounds of half-stock made. The memoranda did not reach back to the time when we made paper. They included the number of pounds of foreign crystal and soda-ash used.

(Counsel for complainants again requests permission of defendants' counsel to inspect the memoranda referred to by the witness.

Counsel for defendants has not those papers enquired for in his possession, and cannot therefore produce them.

The objection to their production, however, as he understands is, that the papers embrace and refer to many experiments made under the directions of the president of the defendants which have no reference to and are not connected with any enquiries made of the witness, and which experiments are not of a public character, and are not intended to be made public.

Counsel for complainants requests their production for his inspection of those parts of the memoranda to which the witness referred.

Counsel for defendants states that they are not in his possession; that he will consider the request of complainants' counsel and give a reply thereto.)

Adjourned until Monday 29th April, 1867, at 11 a. m.

499 MONDAY, *April 29th.*

Present, counsel for respective parties.

Cross-examination resumed:

X 88. Where were the *guages* attached to the alkali-boilers, and how did the steam act on them?

A. As near as I remember, they were attached about the centre. They were attached to the pipes, like all other *guages*.

X 89. Did the opposite end of the pipe, at which the steam entered, open into that part of the boiler which was above the diaphragm?

A. No; below.

X 90. Was the pipe straight, or was the *guage* brought down, so as to be conveniently read?

A. The pipe was not straight, but the *guage* was brought down so as to be conveniently read.

X 91. How near to the diaphragm did the pipe enter the boiler?

A. Probably six feet below.

X 92. How far below that point was the *guage* brought down?

A. It might have been two feet, or it might have been one.

X 93. How much of the pipe connected with the steam-*guage* entered the boiler?

A. I cannot say. I never was inside the boilers.

X 94. Do you not know whether the pipe merely went through the iron of the boiler or extended into the boiler?

A. I do not.

X 95. How far from the boilers was the place to which the steam-*guage* was attached?

A. I never measured it. I should suppose about 18 inches.

X 96. Do you affirm, of your own knowledge, that the opposite end of the pipe connecting the steam-*guage* and the alkali-boiler to that which entered the *guage* was not above the diaphragm of the boiler?

500 A. I am very certain it was not; and the reason I am certain of it is, that we used to get pulp in it occasionally, and had to clean it out.

X 97. How did you clean the pipes connecting the *guages* with the alkali-boilers when they became clogged up with pulp?

A. Sometimes we could blow it out by opening the cock below the *guage*, and sometimes by removing the *guage*.

X 98. How long was the pipe, and to what extent did it become clogged up?

A. About from 4 to 5 feet long, and might have become clogged once a week, or once a month.

X 99. It was clogged up to the *guage* when you removed the *guage* to clean it?

A. Not necessarily at all.

X 100. Where was the safety-valve attached to the alkali-boiler?

A. On the top end of the boiler.

X 101. At what pressures were the safety-valves on the alkali-boilers set to blow off?

A. Never below 40 lbs., and never above 60 lbs.

X 102. When you boiled at a pressure indicated on your steam-*guage* by 60 lbs., they were set to blow off at 60 lbs., were they?

A. Yes.

X 103. Did they ever blow off?

A. Sometimes, if we happened to get the pressure a little too high.

X 104. Were they always set to blow off at a particular number of pounds during the time you boiled at a pressure indicated on your steam-*guage* by 40 lbs.?

A. Yes.

X 105. Were your steam-*guages* on your alkali-boilers ever tested, except by the city authorities, after they were attached to the boilers?

A. They were tested by the Government authorities. The' were not tested by any one else that I am aware of.

X 106. From what boilers did you feed your alkali-boilers with steam?

A. We fed from any one of four sets that we desired to feed from.

501 X 107. Name those four sets.

A. No. 1 was what we called the Cornish boilers; there were two of them; No. 2 were three tubular-boilers; No. 3 was a Harrison boiler; No. 4 were three plain cylinder-boilers.

X 108. What boiler or boilers did you feed your steam guns or cylinders from?

A. Sometimes number 3, sometimes No. 4. Those two sets were put up expressly for that use.

X 109. When you fed your steam guns or cylinders, and your alkali-boilers, from set No. 3 or set No. 4, what pressure or pressures did your steam-*guages* on those sets indicate?

A. When we fed the guns, they indicated from 165 to 175 lbs. When we fed the alkali-boilers, it would run from 60 to 85 lbs. to the square inch; and the reason that we had to keep so high a pressure was, that those sets of boilers were so far away that there was some condensation of steam on the passage to the boilers. Those boilers were not put up to supply steam to pulp with. The boilers that were put up to pulp with were close by, and we never carried ever 60 lbs. on them.

(Last part of answer objected to by complainant's counsel.)

X 110. Which boiler or boilers did you usually feed your alkali-boilers from?

A. For the last four months we fed almost exclusively from the Harrison boiler.

X 111. Previously to that time which set did you usually feed from?

A. From No. 2.

X 112. You sometimes fed your steam-guns and alkali-boilers from the Harrison boiler—set No. 3—at the same time, did you not?

A. No; they were not fed on the same day from the same set.

X 113. Were the boilers from which the defendants, at their mill in South Brooklyn, fed their alkali-boilers, ever connected with, or the same as, the boilers with which they at the same time fed their steam guns?

A. No.

502 X 114. Do you mean, in your last answer, that the boilers were never connected, or the same during the time you were at the mill?

A. They were never connected at the same time while I was there. I refer to the time while I was there.

X 115. How many men had you under you, whose business it was to take care of the alkali-boilers?

A. I had one to superintend that depar'ment. He had under him five men. We used to call him Nick.

X 116. It was Nick's business to superintend the charging and discharging the boilers, and to watch the *guages* and safety-valves, was it?

A. Yes.

X 117. Did you watch the *guages* and safety-valves on the alkali-boilers, during the boiling?

A. I usually knew the pressure that they were under, and I ordered the chief engineer, also, always to know the pressure they were under.

X 118. And after giving them orders, you left it to the chief engineer and Nick to watch the pressures during the boiling?

A. Yes.

X 119. What kind of gauges were those used by you on the alkali-boilers?

A. Bates' patent. They were spring-gauges.

X 120. You say the purpose of the diaphragm in the alkali-boilers was to keep the pulp from going up the steam-inlets. What inlets do you refer to, and was this the only purpose?

A. I refer to the large inlet at the top. It was not the only purpose, but was also to keep the stuff below the surface of the liquor.

X 121. Was the diaphragm stationary; and if so, how made stationary?

A. It was stationary, and was fastened to the main boiler.

X 122. Had the man or feed hole of the alkali-boilers ever been at the top, above the diaphragm?

A. No.

503 X 123. What was the width of the blade of the stirrer in your alkali-boilers? Did it extend on both sides of the shaft?

A. I think that the width of the outer end was about eleven inches; next to the shaft, about four inches. It extended both sides of the shaft alike.

X 124. Did the shafts ever have more than one blade or blades? If so, how many?

A. There was one shaft to a boiler, and two blades on that shaft. They were two propellers, the shaft passing through the center of them.

X 125. How far apart on the shafts were these two propellers?

A. They might have been six feet.

X 126. Describe the discharge cock and valve of the alkali-boilers and the mode of working.

A. It was what is known as a plug-cock. I could not specify whether it was four or six inch. It was worked by a mitre-gear.

X 127. Was there a pipe in the bottom of the boiler, through which you discharged the contents of the boiler, and in which the cock was placed?

A. No; the cock was directly attached to the boiler.

X 128. Did you discharge the contents of the boiler under pressure?

A. Yes.

X 129. Did you manufacture any of the pulp discharged from the alkali-boilers into white paper, at South Brooklyn?

A. Not whilst I had charge.

X 130. Then you made nothing but brown paper during the year you were there, did you?

A. That was all.

X 131. How much of the pulp turned out by you was made into paper at South Brooklyn?

A. I cannot say. We might have made paper there three months. For a time I had charge of making paper there.

X 132. How much pulp did you make at defendants' mill in South Brooklyn?

A. I could not say.

X 133. Please produce samples of the paper and pulp manufactured by you at the defendants' mills.

A. I have not got them to produce.

504 (Defendants' counsel states that the samples of blown bamboo, pulp, &c., referred to by the witness, on his direct examination, will be produced and put in evidence, but that the defendants wished to produce them upon the redirect examination of the witness.)

X 134. What process did you subject the pulp discharged from the alkali-boilers to in manufacturing it into paper?

A. It was washed and cut up in the engine and then run into paper.

X 135. What was it washed in?

A. Water.

X 136. Were any chemicals applied to it?

A. Nothing but sizing or glazing. This is not known as a chemical, though there is a little chemical in it if it is a vegetable sizing.

X 137. How often did you use the rotary Spafford boiler in boiling bamboo or straw?

A. We might have used it a month in the twelve, while I was there.

X 138. Did you use the same solution of caustic alkali in the rotary boiler that you did in the two upright boilers?

A. Yes.

X 139. From what boiler did you feed the rotary boiler with steam?

A. From any one of the 4 sets.

X 140. What was the pressure on the boiler which you fed from when you fed the rotary boiler?

A. When we fed from No. 2 it was 60 lbs.; when we fed from No, 3, it was from 60 up to 85 lbs. We never fed it from No. 1.

X 141. What number did you usually feed it from?

A. From No. 2.

X 142. Between what limits did the pressure on the rotary boiler range, as indicated by its steam-*guage*, when boiled in it?

A. From 40 to 60 lbs. We carried pressure on it the same as on the upright boilers.

X 143. Did the safety-valve ever blow off on the rotary boiler?

A. Yes; I believe it did.

505 X 144. At what number of pounds was the safety-valve on the rotary boiler set to blow off at?

A. The same as on the others, not below 40 nor above 60 lbs.

X 145. When you boiled in the rotary boiler at a pressure indicated by its steam-*guage* at 60 lbs., what pressure did the steam-*guage* on the feeding-boiler indicate?

A. On No. 2, it indicated 60 lbs.; No. 3, 65 to 70 lbs. It was never boiled more than half a dozen times with steam from No. 3.

X 146. You never used the rotary boiler if you could help it, did you?

A. No.

X 147. But its use, such as it was, covered the whole year that you were there, did it?

A. No; it was only the first part that we used it.

X 148. To whom did you sell the paper you manufactured at Brooklyn?

A. I could not say.

X 149. Did you give samples of paper and paper-pulp to parties who visited the mill at Brooklyn?

A. I did to those who had letters from the president or directors.

X 150. And you told such parties what such samples were made from, did you?

A. Yes.

151. Did you show such parties over the mill, and explain to them your mode of operation?

A. Yes; when desired by the president or directors.

X 152. Did you manufacture paper-pulp and paper in the first six months you were at the mill?

A. We manufactured paper-pulp, and a part of the time, paper. I cannot say how much of the time.

X 153. In what respects did your manufacture during the first six months you were there differ from that during the last six months, except those you have stated?

A. In the first six months we boiled our blown material in spent alkali in an open boiler, and then took it out and drained it, and then put it into the pressure boilers and gave it a clean alkali, without washing. The second six months the most of the time, I think, we

506 did not boil in spent alkali, but we washed it in water, and then put it into beating-engines, and there washed and cleansed it. It was then pumped up into a receptacle and drained, and then was put in the pressure-boilers, and given the clean alkali and boiled under pressure.

X 154. Did your operations in the manufacture of paper-pulp and paper differ in any other respects in those two periods?

A. I do not think they did.

X 155. Then your operations in the manufacture of paper-pulp and paper were substantially the same during the year you were at the mill, except in those respects you have stated, were they.

A. Yes; I believe so.

X 156. What did you do at the mill in the first six months, when you were not manufacturing pulp and paper?

A. We manufactured all the time except for a day or two at the time when the mill was out of order or something of that kind.

X 157. Did you boil the straw that you used by substantially the same process, the same solution, and the same pressure as the bamboo?

A. Yes.

X 158. Then there was no difference in your manufacture, whether you had straw or bamboo under process, and what you have stated applies equally to both?

A. Yes.

(The defendants' counsel refuse to produce the memoranda referred to in answer to cross-int. 43. Complainants' counsel request to know the ground of such refusal. The defendants' counsel states that the complainants' counsel are not entitled to the production of the paper.)

Redirect:

Redir. 159. Look at the sample now shown you, marked D'f'ts' Exhibit "H," and state whether it is a sample of the bamboo treated by the defendants, at their works at Brooklyn, as you have previously stated?

A. Yes; this is a sample of the stick.

507 Redir. 160. Was the bamboo put into the steam-guns in the same condition as the sample referred to in your last answer or was anything done to it before it was put into the gun? If so, state what was done to it.

A. It was soaked in water, and then put into the gun.

Redir. 161. Look at the sample now shown to you and marked Def'ts' Exhibit I, and state what it is.

A. That is steam-blown bamboo as it comes from the gun.

Redir. 162. Look at the sample now shown to you and marked D'f'ts' Exhibit K, and state what it is.

A. This is the blown bamboo, washed, and cleansed in the beating-engine. That is all that has been done to it.

Redir. 163. Is that the kind of stuff you put into the alkali-boilers, to be boiled in caustic alkali, under pressure?

A. It is.

Redir. 164. Look at the sample now shown to you, D'f'ts' Exhibit B, and state what it is.

A. It is blown bamboo, washed by hand.

Redir. 165. Look at the sample now shown you and marked D'f'ts Exhibit L. and state what it is.

A. This is the bamboo after it has been blown, washed, and boiled in the caustic-alkali boilers, under pressure, in the defendant's boilers at Brooklyn, and is what we term "half-stock."

Redir. 166. Look at the sample now shown to you, D'f'ts' Exhibit M, and state what it is.

A. It is the same as Exhibit L, picked open with a machine, to mix with fur for making into hats.

Redir. 167. With respect to the pulp that was sent away from the works at Brooklyn, to be made into paper, can you say, of your own knowledge, what paper was made from that pulp, so as to prove samples of the same?

A. No.

Redir. 168. Please refer to the printed pamphlet now shown you, and read the 8th int. put to Mr. Hugh Burgess, a witness for the complainants in this case, and also read the answer to that interrogatory, and state whether Mr. Burgess has, in that answer, correctly stated what he says you told him on the occasion to which he refers in that

508 answer. If not, please state in what respect his said statement is incorrect.

(Witness being shown the printed pamphlet, containing testimony in this case for the complainants, witness says:)

A. He is incorrect, first, in stating the quantity of lime used. He states that I said the quantity of alkali and lime was the same. I used half the quantity of lime that I did of soda-ash. Secondly, he is incorrect in respect to the solution of alkali. The 2,500 gallons of alkali which he speaks of was mostly "spent alkali," and about the quantity of liquid that we used for a charge in the two upright boilers. He speaks of it as being a charge for one while it was, in fact, a charge for two.

Redir. 169. What was the difference, if any, between the pulp from the rotary boiler and the pulp from the upright boilers?

(Objected to.)

A. The only difference that I am aware of is that the pulp from the rotary boiler was knotted up.

(Objected to.)

Redir. 170. Were the upright boilers sufficient for the boiling of the material which you had the means of treating and sending away?

(Objected to.)

A. Yes; after it was washed.

Redir. 171. Was the machinery for making paper removed from the defendants' works at Brooklyn, to be put up at their mill at Stockport? If so, when was that change made?

A. It was removed, and I should say in April of 1860. But I am not certain.

Redir. 172. Do you know whether the paper-making machinery so removed from Brooklyn to Stockport was put up as proposed prior to the stoppage of the works at Brooklyn, or were the arrangements of the defendants for working that mill at Stockport only partly completed?

(Objected to.)

509 A. I understood that the machinery was not put up. I understood that the arrangements for working the mill were only partially completed.

(Objected to.)

Redir. 173. Were the defendants' works at Brooklyn completed as designed by them prior to the stoppage of those works, or was the machinery or apparatus in an incomplete condition, so that they could not treat large quantities of stuff nor treat it as they desired and intended to do?

(Objected to, and also to the form.)

A. They were incomplete. They were able to make only about 3 tons of pulp per day. They were preparing to turn out about 15.

(Objected to.)

Redir. 174. Was the object of the defendants to make paper on a large scale, or was their principal object to supply vegetable fibrous substances disintegrated by the steam-blowing process to paper-makers for them to make into paper?

(Objected to.)

A. It was to supply stock to paper-makers. What paper was made was more for the purpose of showing what the stock would make than for the sale in the market.

Redir. 175. Has the use of the steam-blowing process been recently resumed? If so, when?

(Objected to.)

A. I understand it has, at Elizabethport.

Adjourned until Tuesday, 30th April, 1867, at 11 a. m.

APRIL 30TH, 1867.

Present, counsel for respective parties.

Redirect examination continued:

Redir. 176. You say that the stuff boiled in the rotary boiler is curled. What causes it to be curled?

A. In consequence of the rotary motion of the boiler.

Redir. 177. If an agitator in the upright boilers would work
510 easily, and without causing any trouble, would you use it, or do you consider the agitator to be detrimental to the operation of boiling?

(Objected to.)

A. I would not use it. As far as my experience has gone, it is better without it than with it. I do not think the agitator is of any service.

Redir. 178. If the stuff boiled in the rotary boiler were ground in a Jordan engine, would the knots in the pulp be cut up so as to make the pulp in good condition ready to be run upon the paper-machine?

(Objected to.)

A. Yes.

Redir. 179. Please refer to your answer to the 12th int., and say whether you made that statement from your own recollection.

A. I did.

Redir. 180. Please read the entry you referred to, and hand in a copy of it.

A. I have read, and this is a copy of it. I hand it to the examiner.

Redir. 181. Suppose the complainants, instead of putting chips of wood into their boilers, were to put into them the stuff, a sample of which you have spoken about, Defendant's Exhibit K., would there be any saving of alkali and steam-pressure? If so, to what extent, in your opinion?

(Objected to.)

A. I should think there would be a saving of, at least, two-thirds of the alkali. I don't know that I can say anything about pressure, for I never used our 60 lbs. I do not suppose it would be necessary to use over 40 lbs.

Redir. 182. Suppose the blown and cleansed bamboo-fibre to be put into the boiler dry and pressed, how much paper-pulp could be made from a charge of one of the upright boilers at Brooklyn?

(Objected to.)

A. I should think you could put in 10,000 lbs. of the dry-pressed stuff. I do not think it would shrink over thirty per cent.

Redir. 183. How would the pulp made from the fibre, Defend-
511 ants' Exhibit K, compare with the wood-pulp which you have seen, and which was represented to be made at Manayunk?

(Objected to.)

A. The pulp made from Exhibit "K" would be much stronger.

Recross-examination:

Re-x 184. There was no difference, was there, so far as you know, between straw and bamboo in respect to shrinkage, as you made them into "half-stock?"

A. I could not say that there was any difference. I never made enough of straw to learn.

Re-x 185. In charging your alkali-boilers, you put in some gallons of spent alkali, did you. If so, how many?

A. Yes, we used spent alkali. We used from 1,000 to 1,200 gallons to an egg-boiler charge.

Re-x 186. The stirrers were in constant use until about ten months and four months, respectively, before the mill closed, were they not?

A. I think that I may have used those stirrers for a month after I became superintendent. Then some three or four months before the works closed, Mr. Russell wanted that I put that stirrer, the one that was left in the boiler, in operation, as he thought it would make a difference. I think we used it for two boilings at that time, and we could not see any difference, and we did not use it after that.

Re-x 187. Please produce samples of the following kinds of paper-pulp and paper manufactured by defendants, at South Brooklyn, namely:

Bamboo-pulp, or half-stock, produced by cleansing, blowing in a steam-gun, boiling in open boiler in spent alkali, cleansing in a beating engine, draining and boiling in a close boiler, discharging therefrom and washing.

Straw-pulp or half-stock, produced by the same process.

Bamboo-pulp and straw-pulp, produced respectively by the same processes, when the boiling was carried on at a pressure indicated on your steam-*guage* by 40 lbs. and 60 lbs. respectively.

Bamboo-paper, manufactured from pulp produced by same processes.

512 Bamboo-paper, manufactured from pulp produced by same processes, except the boiling in spent alkali in the open boiler.

A. I have not such samples.

(Counsel for complainants requests the production of such samples of defendant's counsel.

Defendant's counsel has no such samples in his possession. If complainants desire the same, they have power to issue subpœnas duces tecum to such persons as they suppose have them.)

Re-x 188. Look at the sample marked Defendants' Exhibit L, and state whether it was produced by boiling at a pressure indicated in your steam-*guage* by forty or by sixty pounds.

A. I can't answer from my own knowledge.

Re-x 189. Please produce the paper-writing from which you read in giving your answer to the 168th redirect interrogatory.

A. I have not got it; I put it in my pocket and have lost it.

Re-x 190. In whose handwriting was it?

A. In my own.

Re-x 191. When did you make it, and what was the occasion of your making it?

A. I think it was last Friday, the 26th instant. I made it in consequence of R. W. Russell's calling my attention to what Burgess swore to, and he asked me if it was correct. I said to him no; and he asked me wherein it was wrong, and I told him wherein it was wrong; and I made that memorandum.

Re-x 192. Is the entry to which you referred in answer to your 180 re-direct interrogatory the same memoranda to which you had previously referred, or has it been detached from those memoranda. If it has been detached, state by whom; and had the memoranda been in your possession since you delivered them to defendant's counsel upon making your answer to *to* the 43d cross-interrogatory until you re-

513 ceived the entry in giving your answer to the 180th interrogatory. If they have not been in your possession state from whom you received the detached entry?

A. The entry is the same memoranda. I detached it from other memoranda. It was a leaf of the memoranda which I had in my hands the

other day, and which I detached from it this morning. They were not in my possession until this morning. I detached the entry myself and did not receive it from anybody.

Re-x 193. How came you to detach the entry?

A. In order to roll it up and pin ti, so that complainants' counsel could read it.

Re-x 194. State the whole occasion of your detaching the entry.

A. I have stated it.

Re-x 195. From whom did you receive the memoranda this morning?

A. I took it out of W'm P. Arnold's bundle of papers.

R-x 196. What conversation have you had with anybody in reference to those memoranda, since they were called for by complainants and with whom? State particularly the conversation relating to their production by you.

(Objected to.)

A. I do not know that I have any conversation with any one except with W'm P. Arnold. I do not know but I may have spoken to R. W. Russell about them. I said I did not see any objection to letting complainant's counsel see them—the entry I referrrd to. Mr. Arnold said they were willing that the entry should be read, and I then detached it and folded it up.

Re-x 197. Then you pinned up and folded up yourself this part of the memoranda so that nothing could be read but that part, a copy of which you have handed in, did you?

A. I folded it up and then handed in the copy.

Re-x 198. Who pinned it up?

A. William P. Arnold.

(Complainants' counsel calls again upon defendants for the memoranda in the condition in which they were referred to originally by the witness and for the unpinning and unfolding of the part last referred to by him.

514 Defendant's counsel refuses to produce the same, and insists that, having produced to complainant's counsel the original, and having furnished to him a copy thereof of all that the witness referred to on his examination that it is not required to produce anything more or submit any papers of the defendants beyond that to the inspection of the complainants or their counsel.)

JOHN P. TOWNSEND.

Subscribed and affirmed to before me, this 30th day of April, 1867.

KENNETH G. WHITE.

Defendants' counsel puts in evidence:

Copy of an English patent, No. 1922, A. D. 1792, granted Hector Campbell, for the manufacture of paper, and marked Defendant's Exhibit 1.

Also, copy of English patent to William Cunningham, 1794, marked Exhibit 2.

Also, copy of English patent to John Trumbull, j'r, 1800, marked Exhibit 3.

Also, copy English patent to Matthias Koops, 1801, marked Exhibit 4.

Also, copy English patent to James V. Desgrand, 1838, marked Exhibit 5.

Also copy English patent to George D'Harcourt, 1838, marked Exhibit 6.

Also, copy specification English patent to Morton Balmanno, 1838, marked Exhibit 7.

Also, copy specification English patent to Edward Cooper, 1838, and marked Exhibit 8.

Also copy specification English patent to John Small, 1838, marked Exhibit 9.

515 Also, copy specification English patent to Miles Berry, 1839, marked Exhibit 10.

Also, copy specification English patent to Lemuel Wellman Wright, 1843, marked Exhibit 11.

Also, copy specification English patent to Moses Poole, 1844, marked Exhibit 12.

Also, copy specification English patent to Jean T. Coupier and M. A. Charles Mellier, 1852, marked Exhibit 13.

Also, copy of American patent to Watt & Burgess, re-issue of 1858, Oct. 5, marked Exhibit 14.

Also, copy American patent to W'm Magaw, of Feb'y 19th, 1830, marked Exhibit 15.

Also, copy American patent to Wooster and Holmes, of August 3d, 1830, marked Exhibit 16.

Also, copy American patent to J. T. Coupier and M. A. Charles Mellier, of August 2d, 1853, and marked Exhibit 17.

Also, copy American patent to George Spafford, (John Campbell, assignee,) of June 12th, 1850, marked Exhibit 18.

Also, copy of correspondence, &c., connected with grant of American patent to Watt and Burgess, of July 18th, 1854, marked Exhibit 19.

Also, copy of correspondence, &c., connected with grant of American patent, re-issued to Watt and Burgess, (Ladd and Keen, assignees,) reissue No. 608, marked Exhibit 20.

Also, copy correspondence, &c., connected with grant of American patent, granted M. L. Keen, September 13th, 1859, marked Exhibit 21.

516 Also, copy correspondence, &c., connected with grant of reissued letters-patent, to Ladd and Keen, assignees of Watt and Burgess, April 7th, 1863, marked Exhibit 22.

Also, copy of correspondence, &c., connected with grant of re-issued letters-patent to Ladd and Keen, assignees of Watt and Burgess, April 7th, 1863, marked Exhibit 23.

(Objection by complainants to admission of each and every of the foregoing exhibits, marked 1 to 23, both inclusive.)

LEMUEL WELLMAN WRIGHT, called and sworn as a witness on the part of the defendants, deposes and says:

1. What is your name, age, residence, and occupation?

A. Lemuel Wellman Wright; age 77. I reside at 186 Clinton st., Brooklyn, and am a mechanical and civil engineer.

2. Did you ever have a bleaching-mill at Stockport, England? If so, state when you had such mill, and what you bleached there.

(Objected to.)

A. I had a mill at Stockport, Cheshire County, England, for bleaching various fibrous substances, such as cotton cloth and yarns, linen cloths and yarns, and threads. This was commenced about 1839.

(Objected to.)

3. Are you a native of England?

(Objected to.)

A. No, sir; I was born in Plainfield, Sullivan County, New Hampshire.

4. In bleaching, as you have stated, did you boil the materials to be bleached in caustic-alkali solutions, under pressure? If so, what pressure did you use?

(Objected to.)

A. I boiled those in caustic-alkaline solutions, under pressure of from 40 to 80 lbs.

5. Are you the person named in letters-patent granted in England, in the year 1843, for machinery or apparatus for bleaching fibrous substances, and manufacturing the same into paper?

517 A. I am.

6. In your said patent, in declaring the nature of your invention, you mention the peculiar apparatus or machinery employed for the purpose of boiling fibrous substances, straw, jute, wood, &c., by high-pressure steam. Did you have any boilers made to bear high-pressure steam in the boiling of straw? If so, what degree of steam pressure?

(Objected to.)

A. I had boilers made for such purposes at different places. Those boilers were warranted to bear 100 lbs., and I suppose they would have borne 2 or 3 hundred pounds pressure.

7. Have you made any paper from straw according to the process indicated in and described by that patent? If so, when and where did you make such paper? Please produce a sample or samples, if you are able to do so.

(Objected to.)

A. I did make paper from straw according to the process described in that patent. The first paper I made was made at a place in North Wales, called "Hope Mills," near Gresford. That was in 1842 or 1843. This was straw-paper. The next place was St. Mary's Mills, formerly St. Mary's Monastery, in Chalford, Gloucestershire County, about 15 miles from Gloucester City. This was old Friar Bacon's place. The samples produced, marked D'f'ts' Exhibits N. O. P., are papers made from straw-pulp made by me at Chalford, about 1848.

(Objection by complainants to answer.)

8. Was the straw from which the paper was made (samples of which you have produced) boiled in caustic alkali under steam-pressure? If so, what strength of alkaline solution did you use, and what steam-pressure?

(Objected to.)

A. The straw was boiled under high-pressure, and in caustic alkaline solution. The alkaline solution was of a strength of about 8 deg., marked by the hydrometer, by such instruments in use at that time. That means 8 deg. in density above water. The steam pressure used was from 40 to 80 lbs.

518 9. Did you, at the great exhibition of the works of industry of all nations, in London, in the year 1851, exhibit specimens of paper made by you, as you have before mentioned, from straw?

(Objected to.)

A. I did, and I got the prize-medal.

10. Have you exhibited similar specimens in any national exhibition in Paris? If so, when and at what exhibition; and did you so exhibit at the request of the British government? If so, can you produce a copy of any communication in writing containing such request?

(Objected to.)

A. I delivered specimens to Dr. Lyon Playfair, who was instructed by the British government to apply to me for specimens to be exhibited in the exhibition held at Paris, in 1855.

(The paper annexed, marked Defendants' Exhibit "R," is a copy of the original note sent me by Dr. Lyon Playfair, by order of "The Lords of the Committee of the Privy Council for Trade.")

I furnished specimens of straw paper to Dr. Playfair, as requested.

11. Did you, in your said process, empty the boiler as directed by the said patent by the pressure of steam on the top of the pulp in the boiler, and was there a space in the top of the boiler for the steam, as shown in the drawing in the patent.

(Objected to, also to form.)

A. I discharged the boilers, as specified in the patent, and there was a space in the top of the boiler for the steam, as shown in the drawings attached to the patent. The steam-space occupied nearly one-third of the capacity of the boilers. It was not a rotary boiler, it was an upright boiler.

(Objection to last part by complainants.)

12. Have you seen the upright boilers at the works of the defendants, at Red Hook, Brooklyn? Do you know anything about the making of those boilers? If so, state what you know about them.

A. I have seen the defendants' upright boilers, at South Brook-
519 lyn, but I have not seen the inside of them since they have been there. While in England, I was applied to by a man named J. Burroughs Hyde, for drawings for defendants' boilers, which I gave him, which were set up first at Raritan, New Jersey.

13. Was there an opening at the bottom of the boilers through which to discharge the contents by the pressure of steam in the boiler?

(Objected to; also to form.)

A. In the drawings there was provision made in the bottom of the boilers for an opening for discharging them, the same as in the drawings of the English patent; but I never saw the bottom of the defendants' boilers since they were made.

14. When you were working the paper-mill at St. Mary's did you know a Frenchman named Mellier, and did he visit your said mill? If so, for what purpose?

(Objected to.)

A. Two Frenchmen, by the name of Muller and Mellier visited St. Mary's Mill (that was my mill at the time) for the purpose of inspecting and understanding the process of making paper from wheat-straw. That was the kind I always used. I sold out St. Mary's Mill about 1845. Their visit was previous to that time.

15. Did you show him the mill and explain the process to him?

(Objected to.)

A. I did pretty thoroughly, with the view of selling my patent in France to Muller & Mellier.

16. Did you sell your patent for France to Muller and Mellier, and make an assignment of it to them; and was your French patent, if one was obtained by you, for the same invention as is described in your English patent; and for how much did you sell your French patent to them?

A. I obtained a French patent. The specification and drawings were the same as the English. I entered into an agreement to sell it to them for £6,000. I sold it to them, and they were to pay for it in a certain time, but became bankrupt and did not pay me.

17. Did you take out an American patent for the same invention; and if so, when?

520 (Objected to.)

A. I took out an American patent for the same invention, some year or two after. I cannot remember the year.

LEMUEL W. WRIGHT.

Subscribed and sworn to before me, this 20th day of April 1867.

KENNETH G. WHITE,
Examiner.

THURSDAY, *June 6th*, 1867.

Present, George Gifford, esquire, counsel for defendants; Francis C. Nye, esquire, counsel for complainants.

THOMAS HOWLAND, called and sworn as a witness on the part of the defendants, deposes and says:

Q. 1. You have already been examined in this case, have you?

A. Yes.

Q. 2. State whether or not any pulp, made from straw, was at any time received at the defendants' mill at Stockport, New York, from the mill in Brooklyn, to be made into paper at Stockport?

A. Yes, there was.

Q. 3. State whether all of the straw-pulp made at the mill in Brooklyn was sent to Stockport?

A. Yes, it was.

Q. 4. What was done with the straw pulp sent from the mill in Brooklyn to Stockport?

A. Made into brown paper.

Q. 5. Was any of it bleached?

A. No, it was not. It was made into brown paper.

Q. 6. Have the defendants, so far as you know, made and sold any bleached paper made from straw, or from straw mixed with any other material?

A. Not that I know of.

521 Q. 7. Do you know of the defendants using a small boiler for experiments in pulping fibrous materials?

A. Yes.

Q. 8. Do you know of the defendants trying experiments with that boiler in the manufacture of white paper made from straw which had been steam-blown?

A. Yes, I do.

Q. 9. Have you seen any sample or samples of white paper produced by such experiments?

A. I have.

Q. 10. In your evidence heretofore given in this case you spoke of the use by your firm, Beach & Howland, of a Spofford rotary-boiler made for said Beach & Howland, of Fort Edward, Washington County, and put up in the fall of 1852, and that you boiled in that boiler rags, Kentucky rope, and Kentucky bagging. Please state what liquid you boiled those materials in; also state what was the product and where it was made?

(Objected to.)

A. We charged the boiler with soda-ash and lime. The quantity was governed by the quality of the rags we put in; a very dark rag, we increased the quantity of soda-ash and lime; the same as to Kentucky hemp and rope, and which we produced white paper from—all three of

those materials bleached together. It was made at Beach & Howland's mill, at Fort Edward, Washington County.

Q. 11. Was the liquid in which you boiled the materials you have mentioned called caustic alkali?

(Objected to.)

A. It was.

Q. 12. During the period from the fall of 1852 until the first of May, 1853, about how much white paper was made in the manner and of the materials you have mentioned?

(Objected to.)

A. About a ton and a half, on an average, per day.

Q. 13. Who had that mill at Fort Edward after the first of May, 1853?

A. Manning, Peckham & Howland.

Q. 14. What Howland was that?

A. Gardner Howland, of Sandy Hill, which is just above Fort Edward—three miles above.

522 Cross-examination.

15. When did you begin to act as superintendent of the defendants' works at Stockport, 1867?

A. I believe is was in the fall of 1865.

16. Do you mean that you began to act there, at that time, for the Fibre-Disintegrating Company.

A. Yes, I do.

17. When, and in what capacity, were you first employed by the Fibre-Disintegrating Company?

A. First January, 1864; as general superintendent of the paper department.

18. Where did you begin 1st January, 1864, to act as general superintendent of the defendants' paper department?

A. At Elizabethport, New Jersey.

19. And you afterwards became general superintendent of the mill at Stockport, did you not? If so, when?

A. I did in the fall of 1865. I made an error in answering the 15th cross-interrogatory—I meant 1865, not 1855.

20. When did you begin to act as selling-agent of the defendants' paper?

A. In the spring of 1866.

21. Where were you occupied as selling-agent for the defendant?

A. New York.

22. Have you ever been in the employment of the defendants any where else except at Elizabethport, Stockport, and New York? If so, where?

A. Nowhere else.

23. Have you exer visited the works at Red Hook? If so, when.

A. I did when they owned them, sometimes every day and sometimes once in two weeks.

24. When did you last visit their works?

A. About the 1st of July last.

25. Did you visit their works at Red Hook, South Brooklyn, while you acted as the superintendent of the mill at Stockport?

A. Yes; whenever I came to the city.

26. What was the purpose of your visit?

A. To see what improvements they had been making during my absence.

523 27. Was that all you visited those works for?

A. At the time I was at Stockport, it was.

28. What did you go there for when you was their selling-agent in New York?

A. To see what improvements they were making.

29. What else did you go there for at that time?

A. Nothing else.

30. Then you never visited the defendants' works at South Brooklyn for any purpose but to see what improve they had been making, did you?

A. No, except in giving my opinion in arranging paper-machinery. It was nothing but the making of the paper that I had anything to do with.

31. Then the improvements that you went there to see were always connected with the manufacture of the paper from the pulp, were they?

A. They were.

32. You paid no attention to the previous part of the process in producing the pulp, did you?

A. No, I did not pay any attention to it.

33. Were the defendants manufacturing paper from their pulp when you made those visits?

A. Not when I made visits there; when I was superintendent at Stockport.

34. How was it when you made those visits while you were their selling-agent?

A. The same. They had no machinery to make paper with at Red Hook.

35. Yet you went over there to see what improvements they had made in their paper-making machinery, when you knew they had no paper-making machinery there, did you?

A. I went there to see what improvements they were making in pulp.

36. What improvement did you discover?

A. I cannot say what it was. I do not remember.

37. Do you remember any one improvement that you discovered they had made in the manufacture of pulp in all of your visits when they had no paper-making machinery. If so, name it.

A. I do not know of any.

524 38. Do you know anything of the manufacture of pulp at the defendants' works in South Brooklyn, except what you have heard from others. If so, what?

A. No, nothing more.

39. Do you know anything of the quantity or quality of the pulp manufactured by the defendants, at South Brooklyn, except what you have heard from others. If so, what?

A. I do not know anything more.

40. Do you know anything of what was done by the defendants' agents at South Brooklyn with the pulp manufactured there, except what you have heard from others. If so, what?

A. It was all sent to Stockport, to be made into paper there.

41. Do you know that of your own knowledge. If so, when did you learn it, and how?

A. Whenever I was in the city. It was all sent up to Stockport, to be made into paper.

42. Do you know what was done by the defendants' agents at South Brooklyn with the pulp manufactured there, of your own knowledge, when you were not in the city. If so, where did you learn that, and how?

A. All that I know about it is, that they said that all the pulp that was manufactured there was sent to Stockport, to be manufactured into paper.

43. Did you learn what you have stated they did when you were in the city with their pulp in the same way or not. If not, how?

A. In the same way.

44. Then you swear, from what they told you, do you, when you *when you* say that the pulp made from straw and otherwise at South Brooklyn, was sent up to Stockport, to be made into paper?

A. I do.

45. Can you swear, of your own knowledge, that the defendants never manufactured any paper from this straw pulp or bamboo at South Brooklyn?

A. They did manufacture some paper from bamboo at South Brooklyn.

46. Then their agents at South Brooklyn told you that they
525 sent all their pulp up to Stockport to be manufactured into paper, while at the same time you know, of your own knowledge, that they kept some of it at South Brooklyn and made it into paper there?

(Objected to—that the question assumes what the witness had not stated; that is, that they kept pulp at Red Hook, to be made into paper there after the mill at Stock'ort had been set running, and the paper-machinery removed from Red Hook to Stockport.)

A. Not after the Stockport mills were started, as the machinery was all taken away.

47. How do you know that the defendants made bamboo-paper at South Brooklyn, before the paper-making machinery set up there was removed to Stockport?

A. Because I made it myself.

48. Then you have been in the employment of the defendants at South Brooklyn, have you, and when, and in what capacity, and for how long?

A. I was, in the capacity of taking charge of the paper-machinery and making paper.

I cannot say exactly when it was, nor how long I was there making the paper.

49. In what year was it, and in what part of the year?

A. In 1866, somewhere in the summer, if I remember right.

50. Who was the superintendent of the defendants' works at Brooklyn while you had charge of the paper-making there?

A. McCracken; I forget his Christian name.

51. How much paper was made there under your charge, and of what material?

A. I cannot say the amount, the material was bamboo.

52. Was any other material used while you had charge of the paper-making there?

A. No sir; no other.

53. Can you swear, from your own knowledge, that no paper was made at South Brooklyn, by the defendants, from straw-pulp, while you were not engaged there?

A. I have no reason to believe there was any straw-paper made there at South Brooklyn.

54. Do you know, of your own knowledge, whether the defend-
526 ants have made any paper from straw-pulp at their works at South Brooklyn, while you were not engaged there?

A. I am not aware of any straw-paper being made there—not that I know of. I do not think it could have been made there without my

knowledge, because I was there every day when the machinery was running. It did not run without I was there.

55. Do you know, of your own knowledge, or have you learned from others, that no straw-pulp was made at the defendants' mill at South Brooklyn, while you were not engaged there?

A. I never knew any straw-pulp to be made there, either of my own knowledge, or from others.

56. Then if any straw-pulp made there at that time by the defendant' was sent up to Stockport, you do not know it, do you?

(Objected to, that the time referred to is not stated; whether it was while the witness was engaged at the mill at South Brooklyn, or some other time.)

A. I am not aware of any.

Q. Have you previously been examined, as a witness, in a cause in the northern district of New York, in the circuit court of the United States, wherein Coe S. Buchanan was complainant, and Gardner Howland and Joseph B. Palser were defendants?

A. I was.

58. That was before 1863, was it not?

A. It was.

59. When you manufactured paper at Fort Edward, in 1852, and afterwards, as one of the firm of Beach & Howland, state whether you had a safety-valve on the rotary boiler in which you boiled the material for the manufacture of paper?

A. I did not.

60. State whether you had a steam-gauge on that rotary boiler.

A. There was no steam-gauge on the rotary boiler.

61. State how the rotary boiler was supplied with steam?

A. From a pipe from the steam-boiler leading to the rotary boiler in the gudgeon of the rotary boiler?

62. How far was the steam-boiler from the rotary boiler?

527 A. I should think about two feet; just a brick wall between them.

63. State whether that steam-boiler had a steam-*guage*.

A. Yes, it had.

64. What kind of a steam-*guage*?

A. It was one of the round, clock kind, called a spring-*guage*, I believe.

65. Had it also a safety-valve?

A. Yes, sir.

66. At how many pounds was the safety-valve on that steam-boiler set to blow off?

A. Sixty.

67. State how much pressure you considered sufficient, at that time, to be kept up in the rotary boiler, for the purpose of boiling the material under operation.

(Objected to.)

A. From 50 to 60 lbs., (to bleach,) from 12 to 15 hours; that was our general rule for doing it.

68. State, if you know, whether the pressure in that rotary boiler was less than 60 lbs. If so, how much less?

A. I do not know, because I had no safety-valve on the rotary boiler; but I should think it might be 1 or 2 lbs. less, but do not know.

69. State whether about 50 lbs. pressure in the rotary boiler was or was not all that was necessary, so far as you knew, at that time for

bleaching the straw, or anything else you had under operation at the time.

A. We considered 60 lbs. was better then 50 lbs. at that time.

70. State whether you have since learned that a higher pressure than 50 or 60 lbs. is more advantageous for bleaching material under operation.

A. I have—especially on straw.

71. State whether during the boiling in the rotary boiler you did anything to ascertain when the contents were at the boiling point, or when the pressure was nearest up to the pressure in the steam-boiler.

A. We ascertained that when the steam got up high enough to blow off at 60 lbs. pressure in the steam-boiler; we did nothing else.

528 72. State whether the steam from the steam-boiler was used for any other purpose but to supply the rotary boiler.

A. Yes, for the paper-machine; this was at the same time that we were supplying the rotary boiler from the same steam-boiler. There was but one steam-boiler.

73. State whether your firm made any paper at Fort Edward, before you sold out to Manning, Peckham & Howland, from nothing but rope made from Kentucky hemp-tow.

A. We did not.

74. What proportion of such rope did you use with your rags?

A. About 25 per cent.

75. Did you ever use a less quantity?

A. I do not think I did.

76. State whether you tested, by a hydrometer or otherwise, the strength of the alkaline solution that you used at Fort Edward?

A. We did not.

77. Do you know of your own knowledge of the defendants using an experimental boiler at South Brooklyn, while you were not engaged there?

A. I do not.

78. Have the defendants manufactured any white paper at Stockport, from pulp made by them at South Brooklyn, and sent there?

A. They have.

Direct resumed by Mr. Russell:

79. Did you act as superintendent of defendants' mill, at Stockport, from the commencement of their operations at that mill, in making paper from the pulp sent up from Brooklyn?

A. I did.

80. Did you, from time to time, see the pulp at South Brooklyn, which was prepared to be sent to the mill at Stockport?

A. I did.

81. Did you have anything to do with the transportation of that pulp from Brooklyn to Stockport, in the way of suggesting how it should be packed and sent?

529 A. I did.

82. Do you recollect an improvement being introduced at the defendants' works, at Brooklyn, by the introduction of beating-engines, to beat up and work the steam-blown bamboo, before it was put into the pulping-boiler?

(Objected to.)

A. I do.

83. Was that improvement introduced within a year before the 1st of July last, as near as you recollect?

(Objected to the form.)

A. They were introduced the year before the 1st of July last.

84. Were you consulted by the president of the Fibre-Disintegrating Company about the putting up of those beating-engines, and did you watch the erection of them and their operation?

A. I was so consulted and did watch the erection of them, and their operation after they were put up.

THOMAS HOWLAND.

Sworn and subscribed to before me this 6th June, 1867.

R. E. STILWELL,
U. S. Examiner.

Adjourned to the 7th inst., at 10 a. m.

FRIDAY, *June 7th*, 1867.

Present, counsel for the respective parties.

Defendant's counsel puts in evidence certified copy of letters-patent issued by the United States to Lemuel W. Wright, dated the 27th of March, 1847, and which is marked Defendant's Exhibit No. 24.

Also letters-patent issued by the United States to Azel Storrs Lyman, dated the 4th of August, 1858, and which is marked Defendant's Exhibit No. 25.

Also a certified copy of an extract from a German publication, which is marked Exhibit No. 26.

Also a certified copy of an extract from another German publication, which is marked Exhibit No. 27.

530 EMIL VOSSNACH, being called and sworn on the part of defendant, deposes and says:

Q. 1. What is your name, age, and occupation, and where do you reside?

A. Emil Vossnack; age 26; am a mechanical engineer; and reside in New York City.

Q. 2. Do you understand the German and French language', and is one branch of your business the translating of German and French into English?

A. I do understand those languages, and it is one branch of my business to translate them into English.

Q. 3. Look at the paper now shown you, and marked Exhibit No. 28, and state what it is a copy of, and what it was copied from.

A. It is a copy of a French patent, No. 2666, granted to Mr. Gros, of Batignolles, for the employment of broom-plant in the manufacture of paper, dated March 20th, 1847; it is a copy from the Brevets d'Invention, second series, volume 10, pages 94, 95, and 96, printed in the year 1852.

Q. 4. Look at the paper now shown you, and marked Exhibit No. 29, and state whether it is a translation of Exhibit No. 28.

A. It is; and I translated it myself.

Q. 5. Look at the paper now shown you, and marked Exhibit No. 30, and state what it is a copy of and what it was copied from.

A. It is a copy of a French patent, granted to Messrs. Montgolfier Brothers, at Paris, February 7th, 1838, for the manufacture of paper from wood. Also for paste-board of bituminized wood. It is copied from the Brevets d'Invention, 1st series, volume 67, page' 15 to 16, plate 2.

Q. 6. Look at the paper now shown you, and marked Exhibit No. 31, and state whether it is a translation of Exhibit No. 30.

A. It is; I translated it partly myself, and looked over that which I did not translate, and the whole of it is a correct translation.

Q. 7. Look at the paper now shown you, and marked Exhibit No. 32, and state what it is a copy of and what it was copied from?

531 A. It is a copy of the French patent, No. 4566, granted to Mr. Charles Wise, of Paris, for an improved apparatus for treating with lye and bleaching rags and other materials used in making paper, which apparatus can also be adapted to other uses, dated May 12, 1838, and taken from Brevets d'Invention, first series, volume 43, pages 37, 38, 39, and 40, and plate 3.

Q. 8. Look at the paper now shown you and marked Exhibit No. 33, and state whether it is a translation of Exhibit No. 32.

A. It is. I translated it partly myself, and looked over the parts I did not translate, and find it correct.

Q. 9. Look at the papers now shown you, and marked Exhibits No. 34 and No. 35, and state what they are translated from, respectively.

A. Exhibit 34 is a translation from an extract of Exhibit 26; Exhibit 35 is a translation of an extract of Exhibit 27.

EMIL VOSSNACK.

Subscribed and sworn to before me this 7th June, 1867.

R. E. STILWELL,
Examiner, &c.

HENRY B. RENWICK, called and sworn as a witness on the part of defendant, deposes and says:

Q. 1. What is your name, age, residence, and profession?

A. Henry B. Renwick; 49 years of age; residence, New York City; and am a civil and mechanical engineer.

Q. 2. Have you read the copies of letters-patent granted to Morris L. Keen for alleged improvements in boilers, which are annexed to the bill of complaint in this suit, and numbered, respectively, 25418 and 38901, and do you understand the contents of them?

A. I have read the copies and understand their contents.

Q. 3. What do you understand to be described and specified as the invention of said Keen in said patent No. 25418?

A. I have some doubts as to which of two combinations is there specified as Keen's invention, but am convinced that either one or the

532 other of them is a combination described and specified as his invention. One of these combinations is that of a boiler of any form suitable for making pulp, with an expansion-chamber and any kind of stirrers that will act to mix up and stir the pulp, and with a discharge-valve or cock so constructed that the contents of the boiler can be blown off through it. The other combination is that of a boiler provided with an expansion-chamber, (the boiler being suitable for the boiling of wood under pressure,) with stirrers constructed and arranged substantially as described in the patent, and with a blow-off cock as before stated; the substantial construction and arrangement of the stirrers being that they are oscillating rods with vanes or arms projecting from one side only of the shaft, and the shafts being arranged in such manner that when the vanes are turned towards the periphery of the boiler, the boiler may be charged through the man-hole, without the stock falling upon the vanes, or stirring-arms. The better opinion, I think, is that the latter of these two combinations is the one described and specified as of Keen's invention in patent No. 25418.

Q. 4. What do you understand to be described and specified as the invention of said Keen in said patent No. 38901?

A. He first describes and specifies the combination of a boiler suitable for making pulp, with a diaphragm and well. The diaphragm being perforated and extending across the boiler near the upper part thereof, and the well being a tube of perforated or reticulated material, extending from the diaphragm to the top of the boiler; there being a man-hole plate at the upper end of the well, through which the material is charged into the boiler. The object of the combination being to charge the material through the bore or aperture of the well, into that part of the boiler below the diaphragm, in such manner that material introduced through the man-hole above the level of the diaphragm, shall not fall upon or clog up the diaphragm. He also describes and specifies the combination of the boilers with a discharge-pipe and valve, for the purpose of blowing out the contents, arranged at or near the lower part thereof. My opinion is, that "the boiler" in this combination
533 means the boiler provided with a diaphragm and well, and not any boiler proper for pulping; such, for instance, as is described in Keen's patent 25418 of the year 1859, in which patent is described a boiler with a blow-off cock at the bottom, and provided with a diaphragm, but without the well and its connections, described in patent 38901.

Q. 5. Do you understand the construction of the boiler used by the defendants, and which is alleged by the complainants to be an infringement of said Keen's patents; if yea, state from what sources you have derived information of it.

(Objected to.)

A. I think I do understand their construction, having read the testimony hitherto taken in this case on that point, and having been furnished by Mr. R. W. Russell with a drawing which I now produce, and which is marked Exhibit 36, and which he told me was a correct drawing of the vertical boiler used at The Fibre-Disintegrating Company's works at South Brooklyn. I have read from the printed record the depositions of James McCracken, Hugh Burgess, and John P. Townsend.

Q. 6. State whether or not the defendants' boiler, including the stirrer in it, is substantially the same or substantially different from the boiler described and specified in either of said Keen patents, and whether there is anything in defendants' said boiler which is described and specified in either of said patents as the invention of said Keen, and give your reasons for any conclusion you may express.

A. The defendants' boiler has what it may be termed an expansion-chamber, a stirrer, and a blow-off cock; and if Keen's invention, as described and specified in patent 25418, be the combination first enumerated by me in answer to question 3, then the defendants' boiler contains substantially the combination described and specified 25418, but if Keen's invention be the combination enumerated second by me in that same answer, namely, the combination of a boiler suitable for making pulp, with a discharge-valve and with stirrers, so arranged and constructed that the contents being charged, will not fall upon them substantially as described in the patent, then the defendants' boiler does not contain the invention of Keen, described and specified in
534 25418, for the reason that the defendants' has a rotary stirrer, with arms or vanes projecting from four sides thereof, and so arranged in the boiler that when the contents are charged, they are directly in the way of the material as it is thrown into the boiler, and the construc-

tion and arrangement is such that they cannot be moved out of the way of the entering material. The defendants' boiler has no perforated well in it leading through the porforated diaphragm, nor any way of charging the boiler above the diaphragm. The man-hole in defendants' boiler is substantially below the diaphragm, and there is no necessity for a well. The defendants' boiler, therefore, does not contain either of the combinations described and specified as of Keen's invention, in patent No. 38901, unless the combination last described and specified in that patent is a combination of any boiler suitable for pulping with a blow-off cock.

Q. 7. Have you examined, and are you familiar with the contents of the patent granted to Charles Wise by the government of France, May 12th, 1838, as described in the Brevets d'Invention, 1st series, vol. 43, pages 37, 38, 39, and 40, and the plates therein referred to. If yea, state what is therein described, and compare the leading features of it with the boiler described in said Keen patent No. 25418, and explain the bearings or effect of the boiler or apparatus described in said Wise patent upon said Keen patent?

A. I have examined and am familiar with the patent published as stated in the question, having read it at the Astor Library in this city. This patent to Wise describes, first, a rotary boiler, (in that respect like Spafford's, provided with an expansion-chamber, a blow-off cock, and a grating inside of the boiler, which serves to agitate the contents when the boiler is revolved. This boiler has proper man-holes for introducing the material, and pipes for the introduction of steam, and is suitable for the treatment of rags and other matter suitable for the manufacture of paper. In the patent it is stated that the boiler may be made stationary, and the stirrers caused to revolve within it. It is also stated that the boiler may be revolved on its transverse axis, (in which case its axis of revolution would be vertical,) and that, in that case, the grating must undergo the necessary modification, (rendered necessary by the change of axis.) There are other modifications of boiler and other forms
535 of stirrer described in the patent. I therefore find described in this patent a boiler suitable for treating rags, etc., provided with expansion-chamber, a stirrer to agitate the material being treated, and a blow-off cock; but I do not find described in it a stirrer, constructed and arranged as described in Keen's patent 25418, in such manner that the material, being charged thereon into the boiler, shall not fall upon the stirrer. I therefore do not find in this patent of Wise the combination specified, as of Keen's invention, in patent 25418, unless one element of that combination be, any stirrer that will stir the material, and not stirrers constructed and arranged as in the patent.

Q. 8. Have you examined, and do you understand the contents of letters-patent of the United States, granted to Lemuel W. Wright, March 27, 1847; and if yea, compare the boilers therein described, and the leading features of the patent No. 38901, granted to Morris L. Keen, and state the bearing or effect of the boiler or apparatus described in said patent to Wright, upon said Keen patents, or either of them.

A. I have examined and understand the contents of the patent referred to in the question, and the boilers B and F, described therein, and I find, by reference to the patent (including the drawing) of the form usually employed for high-pressure boilers, namely, cylindrical shells with dome-shaped ends. They are set vertical, are provided with expansion-chambers, safety-valve, man-hole plates, apparatus for the admission of steam to heat the contents, and a blow-off or discharging-pipe, and a valve for the purpose of discharging the contents of the

boiler under pressure; and in the respect that those boilers are vertical, have expansion-chambers and blow-off cock, they are, in all respects, substantially identical with the boilers described in Keen's patents Nos. 25418 and 38901. If the combination last described and specified in patent 38901 be the combination of any boiler proper for pulping, with a discharge-pipe and valve properly arranged with reference thereto, for the purpose of blowing out or discharging the contents of the boiler under pressure, then I find that combination described in the patent granted to Wright, referred to in the question.

HENRY B. RENWICK.

Adjourned to 10½ a. m. the 8th inst.

536 SATURDAY, *June* 8, 1867.

Present, counsel for the respective parties.

Q. 9. Assuming what is described in said Wise's patent, and in said Wright's patent, to have been known prior to the time of the alleged invention by said Keen of what is described and specified as his invention in his said two patents, then do you find anything described and specified in either of said Keen patents as his invention, which is in the defendant's boilers, and which is not described in either the patents of said Wise or the patents of said Wright?

A. Under the assumption in the question I do not.

Q. 10. How in any way does the boiler described in the Keen patent No. 25418, dated September 13th, 1859, bear upon or affect the construction of the Keen patent No. 38901, dated June 16th, 1863?

A. In the Keen patent, No. 25418, of 1859, there is described a vertical cylindrical boiler, with a funnel-shaped bottom, to the lower part of which is attached a discharge-pipe, closed by a valve or stop-cock, for the purpose of blowing out the material that has been treated. In his patent No. 38901, the same things, having the same arrangement and the same mode of operation, are described. Therefore, if the invention described and specified in the second claim of this patent be the combination of a discharge pipe and valve, arranged as described with any boiler, or with a vertical cylindrical boiler with a funnel-shaped bottom, then that same combination is described in his prior patent 25418. On the other hand, if the combination described and specified in the second claim be the combination of the discharge pipe and valve, as before stated, with "the boiler" described, that is, a boiler provided with a perforated diaphragm and a perforated well leading from a large hole in the diaphragm to a man-hole, then this combination is not found described in Keen's prior patent, No. 25418.

HENRY B. RENWICK.

Adjourned to the 10th June, 1867, at 11 a. m.

537 MONDAY, *June* 10, 1867.

Present, counsel for the respective parties.

Cross-examination by Thomas S. Jenckes, esq., counsel for complainants:

X-q. 11. What do you understand to be the use of the diaphragm in the Keen boiler and in the defendant's boiler?

A. To prevent the wood or other fibre under treatment from rising up into the expansion-chamber, when the bulk of the whole mass expands in consequence of being heated.

X-q. 12. Describe the expansion-chamber in the Keen boilers, and in the defendant's upright boiler, and the uses of it in each.

A. In one of the Keen boilers the expansion-chamber is a chamber of smaller diameter than the boiler, secured on top of it. In the other it is a space at the top of the boiler, not filled with material when the boiler is charged. In the defendant's upright boiler it is a space at the top of the boiler not filled with the material when the boiler is charged. In all three of them its use is that of a space not filled with material, into which a portion of the charge expands. If this space were not left unfilled some of the charge would escape through the safety-valve when heat was applied.

X 13. How high do you understand that each of the boilers are to be filled with liquid during the operation of boiling?

A. I find no directions in either of the Keen patents as to the height to which the boilers are to be filled with liquid, and I am not able to state how much the mass will expand during the operation of boiling without knowing the temperature at which it is introduced, and that to which it is raised. I would also have to procure a table of expansions to determine the point. In defendant's boiler the materials cannot be charged to fill it higher than the lower part of the man-hole plate tube, which is some distance below the diaphragm. How much the mass will expand while boiling I do not know, for reasons as before stated. I should fill defendant's as high as I could through the
538 man-hole plate tube, and Keen's nearly up to or up to, or a little above the diaphragm if I had found by trial that filling to that extent would leave sufficient room for expansion.

X 14. Is it not intended that each [illegible] should be filled as nearly up to the diaphragm as possible with the wood or other material to be boiled, and to fill each high enough with liquid to be certain that the wood or other material would be submerged during the whole operation of boiling?

A. I should think that the manner of filling both with wood and liquid, set forth in the question, would be the proper one, provided space enough is left in all cases for expansion during the boiling operation; but as before stated in substance in Keen's boilers, the liquid may be charged above the diaphragm, provided room enough is left for expansion. In all cases it would be advantageous, if possible, (and it would certainly be so in Keen's,) so to charge that the wood would be submerged during the whole boiling.

X 15. In the Wise apparatus what do you consider to be the expansion-chamber?

A. When the boiler, represented at Fig. 1 of his drawings, is made stationary, as described, or revolves upon its transverse axis, as described, then the three small chambers on top of which the man-hole plates *gg* are bolted are the expansion-chambers. In the boiler represented at Fig. 4 that part of the boiler which is not charged full of liquid would be the expansion-chamber.

X 16. In your last answer do you assume that the boiler (Fig. 1) is to be filled up to the small spaces below the man-hole with the rags or other material submerged in liquid?

A. do not exactly understand the question. There is no direction in the patent as to the quantity of liquid, except that it is to be sufficient to cover the axis on which the stirrer revolves, nor as to the quantity of rags or other material. I assumed that boiler, Fig. 1, when made stationary or revolving in its transverse axis, was to be charged up to the bottom of the spaces, or to a point some distance below the top of the boiler.

539 X 17. How much below the bottom of the man-hole chambers do you understand that the surface of the liquid should be in giving your last two answers?

A. I do not understand that there is any precise direction upon the subject. In case of a horizontal stirrer a surface of liquid a little above the centre of the boiler would be within the directions of the patent, a higher level would also be within the directions. In case of a vertical stirrer the liquid would, if the direction be followed, fill the boiler to the lower side of the man-hole tubes.

X 18. What do you understand to be the stirrer in the Wise patent?

A. In boiler Fig. 1, I understand the stirrer to be revolving gratings extending like blades from an axis revolving either in the longitudinal or the transverse axis of the boiler. In the boiler Fig. 4 the interior surface of the cage or carcass and the blades upon it forms the stirrer, when it revolves.

X 19. Do you find any direction in using either apparatus in the Wise patent that the liquid should cover the whole of the material during the entire operation?

A. By reference the patent, I do not.

X 20. Do you find any diaphragm in the Wise patents similar to or performing the functions of the diaphragm in the Keen boiler?

A. I do; the cage or carcass, or cylinder pierced with holes of Fig. 4, will serve to keep the wood submerged if the liquid be filled up to, or afterwards during treatment, expands up to or above the level of the top of the cage.

X 21. In case the direction in the specification as translated, Exhibit 33, is followed "and a sufficient quantity of lye or alkaline liquor is poured" "into the cylinder to cover the hollow axis *b b*," what function of the diaphragm is performed by the carcass or cage in the Wise boiler?

A. The directions quoted are in reference to the apparatus Fig. 1, and not to that in which the cage is employed, and they consequently have no bearing upon the function of the carcass of Fig. 4.

X 22. Do you understand the phrase in the description of the functions of the apparatus represented in Fig. 4, in which it is said in Exhibit 33 "that the proper quantity of lye is turned into the
540 boiler by the opening *o o*," gives instruction for turning into that apparatus a different quantity of lye from that directed into apparatus Fig. 1.

A. By reference to the original I find that the exact translation of the words of the original are a "suitable quantity of lye," "is turned," etc., but I do not think that the phrase either in the French, or as quoted in the question, gives instructions for turning into Fig. 4 a different quantity of lye from that directed to be turned into Fig. 1. The directions as to quantity are indefinite as regards either apparatus.

X 23. Assuming that the directions for turning lye into the boiler represented in Fig. 4, is the same as for turning lye into boiler Fig. 1, and that lye should be turned in so as merely to cover the axis of the boiler; in that case what function of the diaphragm in the Keen boilers is performed by the carcass, or cage in the boiler, in the Wise boiler Fig. 4?

A. Under the assumption set forth in the question both as to the directions referring to both boilers, and the direction being to merely cover the axis of the boiler; then the cage would not keep the material submerged, whereas, on the contrary, in Keen's the diaphragm would keep the material submerged provided the boiler was so filled that the level of the liquid was above the diaphragm.

X 24. Where do you find the blow-off cock on the Wise apparatus, and what meaning do you give to the term blow-off cock?

A. I find it described in reference to Fig. 1, and the modifications thereof, and I give to the term this meaning, viz: a valve or cock so placed in reference to a boiler that when it is opened the material with which the boiler is charged may run out through the opening, which the valve closes, or may be blown out if pressure is kept up in the boiler.

X 25. Is there any language used in the Wise patent which instructs you that anything but the liquid is to be drawn off through the valve-cock there described?

A. I think that the fair meaning of the language used in reference to the revolving boiler instructs that nothing but the liquid is to be drawn off through the valve; but I do not see how only the
541 liquid can be drawn off without the application of a sieve to the mouth of the blow-off cock, and no such sieve is described; in the stationery modifications of Fig. 1, there would be no way of getting out all the material treated (pulp) except through the blow-off cock described; but there is no language stating expressly that the material is to be so drawn off.

X 26. Is there any language in the Wise patent which instructs you that the solid contents of the boiler are to be discharged under pressure?

A. After referring to the patent, I state that there is no statement that the solid contents are to be discharged under pressure.

X 27. In the boilers described in Wright's patent, where do you find the expansion-chambers?

A. In the upper parts of the boilers, above the upper pipes, and in the chambers below the man-hole plates or covers.

X 28. Do you find any diaphragms in the boilers B and F, of Wright's patent?

A. I do not.

X 29. Do you find any stirrers in either of these boilers?

A. I do not.

Direct resumed by Mr. Gifford:

Q. 30. Taking the directions as a whole in Wise's patent in regard to the charging, and treatment of material in boiler Fig. 4, what do you gather from them?

A. I gather from them that the cage or carcass is to be filled or partially filled with material, and that sufficient lye is then to be introduced to cover the cage either at the time of introduction or when the lye expands on being heated; the material to be treated being held submerged by the cage or perforated cylinder.

HENRY B. RENWICK.

Subscribed and sworn to before me this 10th of June, 1867.

R. E. STILWELL,
Examiner, &c.

542 EMIL VOSSNACK recalled on the part of the defendant, deposes and says:

Q. 1. Look at paper now shown you, marked Exhibit 36, and state what it is.

A. It is a copy of an English patent, No. 1942, dated Oct. 19, 1853, granted to Watt & Burgess; it is copied from an English publication, and is for disintegrating and pulping vegetable matter.

Q. 2. Look at the two papers now shown you, marked respectively numbers 37 and 38, and state what they are.

A. No. 37 is a copy of a French patent granted to Mess. Watt & Burgess, of London, Sept. 28, 1853, for improvements in the manner of disintegrating and reducing to pulp vegetable substances. It is copied from the Brevet d'Invention, 2d series, volume 29, pages 189 and 190, printed in the year 1858; number 38 is a translation into English of No. 37.

Q. 3. Look at the two papers now shown you, marked respectively Exhibit No. 39 and Exhibit No. 40, and state what they are.

A. Number 39 is a copy of the French patent granted to Mess. Coupier & Mellier, of Paris, No. 5605, and dated May 17, 1851, for means to reduce vegetable fibrous materials to pulp suitable for the manufacture of white paper; it is copied from the Brevets d'Invention, 2d series, vol. 19, pages 145, 146, and 147, printed 1855. Exhibit No. 40 is a translation into English of Exhibit No. 39.

Q. 4. Look at the two papers now shown you, marked respectively Exhibits Nos. 41 and 42, and state what they are.

A. Exhibit 41 is a copy of a French patent granted to a Mr. Cothon Breuil, No. 1440, dated Feb. 12, 1846, for the use of vegetable bark in the manufacture of paper; it is copied from the Brevets d'Invention, 2d series, volume 6, pages 60 and 61, printed 1851. Exhibit 42 is a translation into English of Exhibit 41.

Q. 5. Look at the two papers now shown you, marked respectively Exhibits Nos. 43 and 44, and state what they are.

543 A. Exhibit 43 is a copy of a French patent granted to Mr. Moinier Legoux, No. 6399, dated March 12, 1839, for the manufacture of paper-pulp from every kind of wood, previously reduced to chips, bark, roots, leaves, grass, plants, reeds, tubercular and leguminous root pulp, wheat straw, hay, grasses, mosses, &c., the whole by means of mechanical apparatus and new chemical processes newly applied. It is copied from the Brevet d'Invention, first series, volume 52, pages 413, 414, and 415, and plate 26, printed 1844. Exhibit 44 is a translation into English of Exhibit 43.

EMIL VOSSNACK.

Subscribed to before me this 10th June, 1867.

R. E. STILWELL,
Examiner, &c.

HENRY B. RENWICK, recalled on the part of the defendant, deposes and says:

Q. 1. Have you read the two re-issues of the Watt and Burgess patent, printed at pages 20 to 32 of the bill of complaint in this suit, and the original patent upon which said re-issues were granted. If yea, what do you understand to be the invention which is described in said original patent.

(Objected to.)

(Complainant's counsel desires examiner to state the hour, 4 p. m., at which this examination is commenced, and objects to the examination of the witness upon the subject mentioned in interrogatory and upon any other subject not embraced in his previous examination.)

A. I have read the two re-issues printed, as stated in the question, and also a copy, namely, Exhibit K, purporting to be a copy of the original patent granted to Watt and Burgess, July 18, 1854. The invention described and specified in this original patent is a compound

process for producing pulp from wood or other vegetable substances. The wood is first reduced to fine shavings or cuttings, second it is boiled in a solution of caustic alkali, as I understand, either under pressure or at that of the atmosphere. Boiling, under pressure, being stated to be of considerable service.

544 Third. The shavings are to be washed and pressed.

Fourth. The shavings are now to be exposed to the action of chlorine or its compounds with oxygen for a time determined by trial, the test being that the shavings will drop into a dark pulp when placed in weak solution of caustic alkali. The pulp thus obtained, it is stated, may be washed and bleached by usual or other processes described, and the invention specified is the pulping of wood or reducing it to pulp by treatment in caustic alkali, then subjecting the shavings to the action of chlorine or its compound, and thirdly, the production of the pulp from the shavings by submitting them after being treated with chlorine to the action of weak caustic alkali.

Q. 2. State whether or not the invention described and specified as the invention of Watt and Burgess in said re-issued patents or either of them, is the same, or substantially the same, as what is described as their invention in said original patent, and give your reasons briefly for any conclusions you may express thereon.

A. The invention specified in the re-issued patents are not the same, or substantially the same as that described in the original patent. In both the re-issues there is a statement that the wood-shavings are to be boiled under a pressure corresponding to a temperature of, at, near, or above 300° Fahrenheit in caustic alkali, and that such boiling will reduce the wood into pulp. There is no statement in the original patent that boiling under pressure or under such great pressure is essential, nor that any boiling in alkali will reduce shavings to pulp. That discovery is not even hinted at in the original patent, in which original, on the contrary, it is stated that the shavings after being boiled are still shavings, and are only reduced to pulp by a subsequent treatment, both with chlorine and a weak caustic alkali,—as the inventions specified in the re-issues are all based upon pulp produced from shavings by boiling in alkali under pressure alone; as there is no statement in the original that pulp can be so produced, but the contrary as before stated. The inventions described and specified in the re-issues are, in my opinion, different wholly from the invention described in the original

545 patent, and are not described in the original, nor are any of them described in the original.

Q. 3. Have you examined, and do you understand the contents of the copies of the French patent, granted to Mr. Gros, Exhibits 28 and 29, and the original thereof in the Brevet d'Invention?

A. I have examined, and understand the contents, both of the exhibits and of the printed original; the latter being in the Astor Library.

Q. 4. What is therein described, and how does it bear upon the alleged invention, described in the re-issued process patent, No. 1449, as to being substantially the same, or substantially different from that alleged invention?

A. In the Gros patent, among other things, is described the boiling of wood and bark in solutions of caustic alkali, under pressure, after the fibres of the broom-plant have been rolled, so as to make them stringy, and cut up; the operation being something like that of crushing sugar-cane, and I consider this crushing and cutting to be equivalent to the reduction into shavings, or cuttings, described in the Watt and Burgess re-issue. Both the Gros patent and the Watt and Burgess

patent give the strength of the caustic alkaline solution, but neither of them state the amount of the solution necessary to be used in treating a certain amount of wood. Both Watt and Burgess and Gros give approximately the time necessary for boiling in the solution. Gros says that it should be boiled at a pressure of from three to four atmospheres, and Watt and Burgess at a temperature of, at, near, or above 300° Fahrenheit scale. In my opinion, 290° Fahrenheit is within the limits prescribed by Watt and Burgess, and a pressure of four atmospheres, commencing with a perfect vacuum, as zero, would give a temperature of from 293 to 294° Fahrenheit in pure water, and as near as I can judge and remember from experiments made some years ago by me, a temperature of three or four degrees higher in the alkaline solution, described in Gros' patent. The temperature, therefore, which is described in Gros' patent comes within the limit of temperature prescribed by Watt and Burgess. Gros, like Watt and Burgess, describes the bleaching of the product resulting from the boiling in alkaline
546 lye under pressure, and in all those points, viz, a fine division of the woody fibre, a boiling in caustic alkali for a certain time under pressure, and a subsequent treatment of chlorine. Gros and Watt and Burgess describe substantially the same process, and must, therefore, describe the same resultant or product.

Q. 5. Have you read, and do you understand, the contents of Exhibits No. 34 and 35?

A. I have read them, and understand their contents.

Q. 6. How do the operations therein described compare with or affect the novelty of the alleged invention described in said process patent, No. 1449?

A. The operations described therein are the boiling of straw in strong lye, under a pressure of from six to eight atmospheres, which would give a temperature from about 320 to 343° Fahrenheit. The statement is, that the straw thus treated is almost as it were dissolved, from which I should infer that it was reduced to a tolerably fine pulp. In so far as the boiling under pressure of woody fibre in strong lye is concerned, it is substantially the same with the process described in the patent, No. 1449.

HENRY B. RENWICK.

Subscribed and sworn to before me this 10th June, 1867.

R. E. STILWELL,
Examiner, &c.

EDWARD S. RENWICK, called and sworn as a witness on the part of defendants, deposes and says:

Q. 1. What is your name, age, residence, and profession?

A. Edward S. Renwick; 44 years of age, and upwards; reside in the city of New York; I am a consulting-engineer, and am engaged principally in soliciting patents for inventions, and in acting as expert in patent causes.

Q. 2. Have you read the copies of letters-patent granted to Morris L. Keen for alleged improvements in boilers, which are annexed to the bill of complaint in this suit, and numbered respectively 25418, and 38901, and do you understand the contents of them?

547 A. I have read the copies referred to in the question, and believe that I understand their contents.

Q. 3. What do you understand to be described and specified as the invention of said Keen in said patent No. 25418?

A. The invention of said Keen, as described in the said patent No. 25418, as I understand it, is a peculiar boiler for making paper-pulp, constructed with an expansion-chamber, stirrers, and discharge-valve or cock, arranged substantially as described in the patent, for the purposes to be accomplished, that is to say, the expansion-chamber is a portion of the space within the boiler which is separated from the remainder by a perforated diaphragm, which permits the passage of liquid, but prevents the passage of the solid matter or material to be operated on. The stirrers are arranged within the portion of the boiler that contains the solid material, so as to stir it or agitate it during the boiling. The discharge-valve or cock is arranged at the bottom of the boiler, so that the contents may be discharged through it. The patent describes a peculiar arrangement of stirrers, which permits them to be moved out of the way of the material as it is thrown into the boiler; but I am not certain that this peculiarity of arrangement is one of the characteristic arrangements of the invention or not.

Q. 4. What do you understand to be described and specified as the invention of said Keen in said patent No. 38901?

A. The invention of said Keen, described in the patent No. 38901, consists, as I understand it, of two improvements in boilers for making paper-pulp. The first of these improvements is a boiler provided with a perforated diaphragm (which divides it into an upper and a lower chamber) and a well or perforated passage extending from an opening or charging-hole in the upper part of the boiler, through the upper chamber (above the diaphragm) to an opening in said diaphragm, so that material introduced through the charging-hole can pass directly to the lower chamber of the boiler (below the diaphragm) without falling upon the diaphragm or choking its openings, the walls of the passage or "well" (as it is called in the patent) preventing the material so charged from coming in contact with the diaphragm.

548 The second improvement, as I understand it, consists of the combination of the said boiler with its diaphragm and well, (or passage for the material,) with a discharge-pipe and valve at the bottom of the boiler for the purpose of permitting the contents of the boiler to be discharged.

Q. 5. Do you understand the construction of the boiler used by the defendants, and which is alleged by the complainants to be an infringement of said Keen patents? If yea, state from what sources you have derived information of it.

A. I believe that I do. I have derived my information from the examination of Exhibit No. 36 and the explanations of Mr. George Gifford.

Q. 6. State whether or not the defendants' boiler, including the stirrer in it, is substantially the same or substantially different from the boiler described and specified in either of said Keen patents, and whether there is anything in defendants' said boiler which is described and specified in either of said patents as the invention of said Keen, and give your reasons for any conclusions you may express.

A. The defendants' boiler, as I understand it, is constructed substantially the same as the boiler specified as the invention in the Keen patent No. 25418, unless that invention be limited to the peculiar arrangement of stirrers, described and represented in the drawings of the patent, which permits the stirrers to be moved out of the way of the material as it is thrown into the boiler, that is to say, the boiler of the defendants, as represented by Exhibit No. 36, has an expansion-chamber or portion of its space separated from the remainder by a perforated

diaphragm, and has, in addition, stirrers of some kind, and a discharge valve, arranged at the bottom of the boiler, to permit the discharge of its contents; but the stirrer is so arranged that it is in the way of the material thrown into the boiler, so that said material would fall upon it.

The defendant's boiler, as I understand it, is substantially different from each of the improvements set forth in the Keen patent No. 38901, because it has no well or passage extending from the charging-hole through the space or upper chamber above the perforated diaphragm to an opening in said diaphragm, for the purposes described in the said patent, or for any other purpose. In the defendants' boiler, on the contrary, the charging-hole is arranged below the perforated diaphragm, so that the material is charged into the boiler below the diaphragm, and the use of a perforated well or any equivalent therefor, for the purpose of preventing the material from falling upon the diaphragm, is unnecessary.

Q. 7. Have you examined, and are you familiar with, the contents of the patent granted to Charles Wise by the government of France, May 12th, 1838, as described in Brevets d'Invention, 1st series, vol. 43, pages 37, 38, 39, and 40, and the plates thereon referred to? If yea, state what is therein described, and compare the leading features of it with the boiler described in said Keen patent No. 25418, and explain the bearings or effect of the boiler or apparatus described in said Wise patent upon said Keen patent.

A. I have examined what purports to be a copy of the patent of Wise referred to in the question, which patent is marked Exhibit 32, and also a translation of the same, marked Exhibit 33, and I believe that I understand their contents. The said Wise patent describes two apparatuses for treating rags and other materials employed in the manufacture of paper with an alkaline liquid, and the bleaching of them. The first of these apparatuses, as I understand it, consists of a boiler having suitable openings for the charging and discharging of its contents, which openings are provided with covers that may be tightly closed; also with a short pipe and stop-stock for the purpose of discharging the liquid contents; also with a stirrer or agitator for the purpose of stirring the contents of the boiler, and with a perforated pipe for the purpose of introducing steam into the boiler. The description states that the grating or stirrer may be oscillated to and fro a limited distance within the boiler, and that the boiler may be turned upon the shaft while the materials are under treatment within it. The description also states that said apparatus may be modified by placing two or more grates in the interior of the cylinder or boiler; also that the cylinder or boiler may be fixed and the grate or stirrer made to turn, or that the cylinder may have an oscillating motion given to it. The description states further that the cylinder or boiler may be made to turn upon its transverse axis, and that the grate, which is the stirrer, may be modified to suit this arrangement.

The second apparatus described in said Wise patent has a boiler, with a cover sufficiently large to allow the introduction of an interior cylinder, which, as described, is a cylindrical cage, whose sides have numerous small openings, so that it is a cylindrical diaphragm or partition inside of the boiler, and divides the space of the boiler into two chambers—the one within the cage, (for the material to be treated,) and the other outside of the cage, and into which the material under treatment is prevented from entering by the perforated walls of the cage. The interior of the cage is provided with points or teeth, which project inwards,

and the cage is provided with trun'ions, which pass through stuffing-boxes in the ends of the boiler, and terminate in journals, to one of which a gear-wheel is fitted, by means of which the cage may be turned. The cage is provided with an opening for the introduction of the material, and a cover by which the said opening may be closed. There is a representation in the drawing of what I understand to be a charging-hole, and cover therefor, on the upper side of the boiler. The drawing shows a furnace, by which the boiler is heated, and the description states that fire is kindled in this furnace. The description states that, after the operation upon the material is completed, the lye is drawn off, from which I understand that the boiler is provided with a pipe and stop-cock, such as are represented and described in reference to the first apparatus, and which are arranged at the lower side of the boiler. The description states that the apparatus may be modified as respects its form and the manner in which the necessary movement is to be imparted to the apparatus. When the said cage within the boiler is turned, the material within it is necessarily stirred or agitated by the points or teeth which constitute the stirrers of the apparatus.

The bearing or effect of the apparatus described in the said Wise patent upon the Keen patent No. 25418, as I understand it, is to anticipate the invention set forth therein as the invention of Keen, unless it be restricted to the peculiarities of the stirrers (viz, the arrangement of them, so that they can be turned out of the way of the material
551 as it is thrown into the boiler) and the arrangement of the discharge-valve or cock, not only at the lower part of the boiler, but also in connection with that portion of the space of the boiler in which the material to be treated is contained; because one of the apparatuses described in the said Wise patent has a boiler, the space of which is divided into two chambers, which are separated by the perforated cage or partition, so that the material under treatment is held submerged and prevented from passing into the outer chamber, which thus is, in substance, the same as the expansion-chamber described in said Keen patent; and the said apparatus has also a stirrer for the purpose of stirring the material, (which stirrers are the revolving points or teeth,) and has also a discharge-cock arranged at the lower side of the boiler.

Q. 8. Have you examined and do you understand the contents of letters-patent of the United States granted to Lemuel W. Wright, March 27, 1847? and, if yea, compare the boilers therein described, and the leading features of the patent No. 38901, granted to Morris L. Keen, and state the bearing or effect of the boiler or apparatus described in said patent to Wright upon said Keen patent, or either of them.

A. I have examined and believe that I understand the contents of a certified copy of the patent of Wright referred to in the question. The said patent describes two boilers designated by the letters B and F, in the drawing, which are substantially the same with the boilers described in the two Keen patents referred to in the question; that they are closed vessels for the purpose of boiling straw or other fibrous substances under pressure, in an alkaline liquid; also that they have means for heating the material within them, and a pipe and a stock-cock for discharging the contents from the lowest part of the boiler; but the said boilers of the Wright patent differ from the boiler described in the Keen patent, No. 25418, in the respect that the former have no perforated diaphragm or stirrers, and differ from the improvements described in the Keen patent, No. 38901, in this respect, that the said Wright boilers have no perforated diaphragm nor well or perforated passage.

Adjourned to June 10th, at 10½ o'clock a. m.

552 MONDAY, *June 10th*, 1867.

Present, counsel for the respective parties.

Q. 9. Have you read the two re-issues of the Watt and Burgess patent, printed at pages 20 to 32, of the bill of complaint in this suit, and the original patent upon which said re-issues were granted, and do you understand the contents of the same?

A. I have examined certified Patent-Office copies of the two re-issues of the Watt and Burgess patent, referred to in the question, and also, a certified patent-office copy of the original patent referred to, and believe that I understand the contents of all of the same.

Q. 10. What do you understand to be the invention and the only invention which is described or made known in or by said original patent?

(Objection to both form and substance.)

A. The only invention which I understand to be described in said original patent is a compound process for pulping and disintegrating shavings of wood and other similar vegetable matter; such compound process consisting of three operations, performed in regular order and successively, upon the shavings of wood. The first of the three operation' is the boiling of the shavings in a solution of caustic alkali with or without pressure. The second operation is the treatment of the shavings with chlorine, or the compound of chlorine with oxygen, until the said shavings are so affected that they will fall into pulp, when treated by a dilute solution of caustic alkali. The third operation is the treatment of the shavings that have been subjected to the two preceding operations, with a weak solution of caustic alkali; whereupon they will fall into a pulpy mass of a dark brown color; thus completing the pulping and disintegration of the shavings. Each of the above operations is an essential part of the compound process constituting the invention set forth in the patent, and in following out the description of the patentees, the whole three operations must be effected in order that the pulping or disintegration of the shavings of wood and other similar vegetable matter shall be accomplished. In per-

553 forming the first operation, which is preparatory to the other two, and fits the shavings to be penetrated by the chlorine or compound of chlorine and oxygen—the patent describes that the shavings are to be boiled in a solution of caustic alkali, and does not prescribe that boiling under pressure is essential, although it states that that kind of boiling is of considerable service—hence, if a person seeking to practice the invention should boil the wood-shavings in a solution of caustic alkali in an open vessel, and was subsequently to treat them with the chlorine and weak caustic alkali in the manner described in the patent, he would practice the compound process described in the patent; which process, as I understand it, appears to be based upon the discovery that shavings of wood and other similar vegetable matter so prepared as to be penetrated by chlorine or the compound of chlorine and oxygen, will be so charged by the action of the chlorine or said compound, that they will fall into pulp and be disintegrated when treated by a weak solution of a caustic alkali. The patent describes that the dark pulpy mass obtained by the compound process above described may be bleached by the usual process, consisting substantially in subjecting the pulpy mass to the action of the hypochlorite of soda, or some other alkali, and the liberation of the hypoclorous acid by the application of hydrochloric, or muriatic acid, as it is commonly called; but this bleaching operation, as I understand it, is no part of the invention set forth, which is completed when the dark pulpy mass is obtained upon the completion of the three operations which constitute the compound process.

Q. 11. Describe the article produced by that process.
(Objected to.)

A. The article produced is a dark pulpy mass or a pulpy mass of a dark brown color, suitable to be manufactured directly into brown paper by the usual mechanical operation, or to be bleached so as to make white paper when subjected to the usual mechanical operations; and this pulpy mass is the product due to the action of the chlorine upon the shavings of wood or other vegetable matter, and this subsequent treatment by a weak solution of caustic alkali.

554 Q. 12. Are said re-issued patents or either of them for the alleged invention of Watt and Burgess described in the original patent or any part thereof? Give your reasons in full and in detail for any conclusions you may express in answer to this question.
(Objection as to form and substance.)

A. Neither one of said two re-issued patents is for the alleged invention of Watt and Burgess, or for any part thereof. The invention set forth in re-issue No. 1449, as I understand it, consists of two processes. The first of which is a simple process, consisting of the one operation of boiling wood or other vegetable substance in an alkali, under a pressure corresponding with a temperature of from 300°, or thereabouts, to 500°; whereby the material operated upon is at once converted into a "pulp."

The second process is a compound process, consisting of two operations, the first of which is the first process above mentioned by me, and the second operation is the treatment of the "pulp" thereby produced with chlorine and its compounds with oxygen. This second process appears to be limited to the treatment of resinous woods, and to the purpose of making white pulp for the manufacture of paper from such wood. Both of the said processes appear to be based upon the discovery that wood is converted into "pulp," or disintegrated by the single operationof boiling it in a caustic alkali at a sufficiently high pressure, equivalent to a temperature of from about 300 to 500 degrees, without any subsequent operation. No discovery or suggestion or indication of such a discovery is set forth in the original patent of Watt and Burgess; but on the contrary, a substantially different discovery appears to be the basis of the invention or compound process described in that patent, viz: that wood-shavings, when sufficiently penetrated by chlorine, will drop into pulp when treated by a weak solution of a caustic alkali. No description or indication or suggestion is given in the original patent that the shavings of wood should be boiled in a caustic alkali not below a pressure corresponding with a certain high temperature, (300° or thereabouts,) or that such boiling would convert the wood-shavings into "pulp" without the subsequent treatment by chlorine and weak caustic alkali; but, on the contrary, the original patent, by directing that the wood-

555 shavings are to be boiled in the alkaline solution without designating any pressure at which they are to be so boiled by denominating them after such boiling as "shavings," (not pulp,) and by stating that the conversion of the "shavings" into pulp is produced by the action of the chlorine and weak alkali, distinctly prescribes the last two operations as pulping operations proper, and the first operation of boiling in alkali as merely a preliminary operation to prepare the "shavings" for the other two operations. The first process, a single operation, described in the said re-issue No. 1449, is thus a substitute for the compound process of three operations described in the original patent, and is not only not a part of said compound process, but is a substantially different process, enabling two of the essential operations of the process

described in the original patent to be dispensed with in producing "pulp" from shavings of wood and other similar vegetable matter.

As the second process of said re-issue No. 1449 comprehends the first process (that is, the peculiar boiling in caustic alkali, and a pressure corresponding with a temperature of about 300° or upwards to 500°) as the first of the two essential operations of which such second process is composed; and as such first process is not described, indicated, or suggested in the original patent, the said second process is necessarily substantially different from the compound process set forth as the invention in said original patent, and is no part of said compound process.

The invention set forth in re-issued patent No. 1448, as I understand it, is a new article of manufacture, consisting of a "pulp" produced from wood or other vegetable substances by boiling the same in an alkali under a pressure corresponding with a temperature not less than about 300° or upwards to 500°, without subsequent treatment. Such a product is nowhere described or suggested in the original patent of Watt and Burgess; but, on the contrary, there is described in that original patent a different product, viz, a pulp or pulpy mass of a dark-brown color, which is the result of the action of chlorine and a weak solution of caustic alkali upon shavings of wood, or similar vegetable matter prepared for such action, by a preliminary boiling in caustic alkali. The only other product, having the form of pulp de-
556 scribed or suggested in the said original patent, is the bleached product obtained by subjecting the dark, pulpy mass to the bleaching operation, which product is necessarily a substantially different article from the unbleached pulp obtained by boiling shavings of wood in caustic alkali, under a pressure corresponding with a temperature of from about 300° to 500°, first, because the intermediate product is obtained by the pulping action of chlorine and a weak solution of caustic alkali; and, secondly, because the bleaching produces certain chemical changes in the material, which are not effected by boiling the material in caustic alkali at any pressure, high or low. There is a material described in the said original patent as the product of the first operation of boiling in alkali, but that product is described as "shavings," and after washing and pressing as "damp shavings," which is necessarily a substantially different article from a "pulp"; and therefore the pulp described as the product of boiling wood-shavings in the caustic alkali at the temperature prescribed in the re-issued patent No. 1448 is a substantially different article from the "shavings," which are the product of the boiling in caustic alkali, described in the said original patent.

Q. 13. Have you examined, and do you understand, the contents of the copy of the French patent granted to Mr. Gros, Exhibit No. 29?

A. I have examined the copy of the French patent, or, more properly, the translation of the same, marked Exhibit No. 29, referred to in the question. I have also examined the publication of the French patent of Gros in the Brevet d'Invention, of which Exhibit No. 29 appears to be the translation, and I believe that I understand the contents of the same.

Q. 14. What, if anything, is therein described, which bears upon the alleged invention described in the re-issued process patent, No. 1449; and explain in what way, if at all, it affects or compares with said alleged invention.

(Objected to.)

A. The said patent describes, among other things, the reduction of the woody matter of the broom-plant to a state similar to oakum, and

the cutting of it up into small pieces; also the boiling of the said woody material in caustic alkali, with pressure of from three to
557 four atmospheres, which would correspond with a temperature from about 278 to about 298°; it also describes the treatment of the material after it has been boiled twice in the caustic alkali, under pressure, with chlorinous gas, as the Gros patent thus describes the boiling of the reduced woody matter in a solution of caustic alkali, and under a pressure which is substantially within that prescribed in the re-issued patent No. 1449, it describes substantially the same process as the first of the two processes set forth in that re-issued patent; and as the said Gros patent describes the treatment of the said woody matter with chlorine, after it has been so boiled under pressure in the caustic alkali, the said Gros patent describes substantially the same process as is set forth as the second process in said re-issued patent, No. 1449. I have said that the pressure prescribed in the Gros patent is substantially within that prescribed in the re-issued patent, No. 1449, because I do not understand the words "at, near, or above 300°," in said re-issued patent, to limit the lowest temperature to precisely 300°, but that a temperature a little lower than 300°, say down to 290°, would be substantially within the description of the said re-issued patent; and, as a temperature of pure water when boiled under a pressure of four atmospheres, (measuring from a vacu'm as zero,) would be about 294°, and the temperature of a solution of alkali, boiled under the same pressure, would be three or four degrees higher, say 297° or 298°, and the Gros patent prescribes the boiling of the woody material in a solution of caustic alkali, under a pressure of four atmospheres, the pressure and temperature described in said Gros' patent are within the pressure and temperature described in said patent, No. 1449, and therefore the Gros patent describes the invention set forth in said re-issued patent, No. 1449.

Q. 15. Have you read, and do you understand, the contents of Exhibits 34 and 35?

A. I have; and believe I understand their contents.

Q. 16. How does the operation therein described compare with or affect the novelty of the alleged invention described in said process patent, No. 1449?

(Objection by complainants)

A. The said exhibits describe, among other things, that straw
558 is once or more boiled in a strong lye, under a pressure of from six to eight atmospheres, and consequently almost, as it were, dissolved; a pressure of from six to eight atmospheres, measuring from a vacuum as zero, would correspond with a temperature varying from 322° of Fahrenheit's scale to 347 degrees, or thereabouts, varying a little with the strength of the lye. By the words "strong lye," in these descriptions I understand a solution of caustic alkali, because, so far as I know, the strong lye universally used by paper manufacturers at the dates of the publication of the exhibits was a solution of caustic alkali; therefore, as I understand the said descriptions, they describe the process of treating a vegetable substance by boiling in an alkali, under pressure, as a process or preparatory process for making pulp for the manufacture of paper from such vegetable substance, which is described as the first process in the said re-issued patent No. 1449; the pressures corresponding with the temperatures 322 deg. and 347 degrees, being within the pressures corresponding with the temperatures at, near, or above 300 deg. up to the 500 deg., prescribed in said re-issued patent.

Q. 17. Do you know what is the effect produced upon wood-fibre by

subjecting it to a temperature of from 400° to 500° Fahrenheit? If you do, state what would be the effect.

A. I do; from experiments made by me some years ago. I had occasion to subject wood to a steam-heat at a temperature of about 380°, and the effect was to convert it into charcoal; from which I infer that subjecting it to temperatures of 400° to 500° would produce the same effect, the lowest of these two being higher than the temperature at which I experimented.

Cross-examined by Mr. Jenckes:

X 1. When were you first requested to examine the patents referred to in your direct examination for the purpose of testifying in this case?

A. I was first requested to examine them, for the purpose of testifying in this case, some time previous to last Tuesday, June 4th,
559 but I think it is proper to state that I had examined the greater part of them long previous to that date, for the purpose of testifying in another case.

X 2. In what other case?

A. I do not know the title of it, but I was requested to make the examinations by Mr. Howland, of the firm of Howland & Palser, so as to prepare myself to testify in some case in which he either was, or expected to be, engaged. I do not now recollect which he said; it was two or three years ago.

X 3. Have you made any chemical experiment since last Tuesday, to test the correctness of any matters concerning which you have testified?

A. I have not.

X 4. Is not the operation or process described in the original American Watt & Burgess patent purely chemical?

A. As I understand it, it is.

X 5. Are not the operation or operations described in the re-issued patent No. 1449 entirely chemical?

A. As I understand them, they are.

X 6. Is not the product described and claimed as the invention of Watt & Burgess, in re-issued patent No. 1448, the result of purely chemical process?

A. As I understand it, it is; and I think I should add, that it is the product of a single operation constituting such chemical process.

X 7. Have you seen and examined the pulp and the paper made from the pulp which is claimed to be the result of this chemical process?

A. I never saw either the pulp, or paper made from pulp, which I knew to have been the result of the said chemical process, but I have seen dried sheets of paper-pulp which I was informed had been produced by such process at an establishment near Philadelphia.

X 8. Have you any doubt that pulp, suitable for the manufacture of paper such as you now see in the exhibit marked Exhibit F. C. Nye, E. S. R., can be produced from wood, by the process described in re-issued patents Nos. 1448 and 1449?

A. I have not, provided the heat be maintained below the
560 point at which wood-fibre is charred. If the heat were carried above 400° to 500°, as described in the patent, I have no doubt that such paper could not be produced by the said process.

X 9. Have you any doubt that pulp suitable for the manufacture of paper can be produced from wood boiled in a strong caustic alkaline solution at a pressure considerably less than a temperature of 300°, or

in an open vessel, if the product of this first boiling be treated with chlorine or its compounds with oxygen, and with or without a subsequent alkaline treatment, according to the nature of the wood?

A. I have doubts as to whether pulp suitable for the manufacture of paper can be produced from wood boiled in a strong caustic alkaline solution in an open vessel, or at a pressure considerably less than 300°, if the product be treated with chlorine or its compounds with oxygen, without subsequent alkaline treatment. And when making this statement I understand a strong caustic alkaline solution to be one of a density of from 10° to 15° of Beaumé, which would be a strong solution compared with that usually employed by paper-makers. What the effect of a saturated solution of a caustic alkali upon wood would be I do not know, as I have never tried such a one, nor seen an account of the result of such a trial. I also understand that the question has reference to the production of the pulp by the operations referred to in it, and without performing some supplementary operations upon the material.

X 10. Have you any doubt that pulps suitable for the manufacture of paper can be produced by the proces' described by you in direct interrogatory 10?

A. I have not.

X 11. In giving that answer did you not assume that the first of the operations referred to may be performed in an open vessel?

A. I did, and I should also state that I also assumed it might be performed in a closed vessel.

X 12. Do you consider the specification of the original American Watt & Burgess patent a sufficient description of the mode of making paper-pulp from wood described by you in your answer to the 10th interrogatory?

561 A. I do, but I am not prepared to give any opinion as to the quality of the paper-pulp made by it, as I have never seen the process practiced.

X 13. Have you, in your direct examination, been referred to any patent or work by which a pulp suitable for the manufacture of paper has been produced from wood by a purely chemical process?

A. Understanding that the interrogatory is limited to the peculiar vegetable material called "wood," and excludes the mechanical washings, I have not been referred to any patent or work by which a pulp suitable for the manufacture of paper has been produced from "wood" by a purely chemical process.

X 14. So far then as anything exhibited to you in your direct examination is concerned, such a product from wood would be new or a new article of manufacture, would it not?

A. I am not prepared to say whether it would or would not be, because the article so produced may, for aught I know to the contrary, be identical with the product obtained from woody matter by processes described in the patents or works that I have been referred to in my direct examination.

X 15. If not identical with those would it not be a new product?

A. So far as I know it would.

X 16. Do you find any claim of this product as a new manufacture in the original American patent of Watt & Burgess.

A. I do not.

X 17. Do you know of any difference between pulp produced from wood by the process described in your answer to direct interrogatory 10th, and that produced by the single process described by you in your

answer to direct interrogatory 12 as the first process described in re-issued patent No. 1449.

A. I have not made any tests for the purpose of ascertaining whether there is or is not any absolute difference, chemical or physical, between pulps produced from wood by the two processes referred to in the question, but I have no doubt that there would be a difference between the two, because the chemical processes to which the wood is
562 subjected to make the two pulps are substantially different, and I have no doubt that if no other operation be performed upon the material than the said two processes the two pulps will differ in their chemical constitution.

X 18. Do you not know that the fibre to be obtained from wood for the purpose of manufacturing paper is what is termed pure cellulose?

A. I do not. I know that the ultimate fibrous matter that can be obtained from wood is pure cellulose, but I doubt whether it is ever obtained in the manufacture of ordinary paper.

X 19. Supposing it to be obtained, does it make any difference by what chemical or other process it is obtained?

A. It does not, so far as the chemical constitution of the article is concerned.

X 20. Then if the tests disclose that the results produced by the single operation of boiling in alkali at a high temperature, and also by boiling in alkali at a low temperature and subsequent chlorine treatment, or subsequent chlorine and alkaline treatment, be the same, the difference spoken of by you in your answer to the 17th cross-question would not exist?

A. As I understand your question it would not, because the result obtained in each case would be the well-known chemical substance called cellulose.

X 21. Is not the object of the chemical treatment of wood or any substances for the production of pulp for the manufacture of paper the removal of the intercellular tissues of the substance submitted to the chemical agencies?

A. This is one of the objects; another object is the decolorization or bleaching of the product.

X 22. Is it not pulp fitted for the manufacture of paper as well before as after it is bleached?

A. It may be suitable for the manufacture of brown paper.

X 23. It will be so, if it be pure cellulose, will it not?

A. No. I should say that if it were pure cellulose, it would be suitable for the manufacture of white paper, because pure cellulose is white.

X 24. Will it not be fit for the manufacture of brown paper if all the intercellular matter be removed?

563 A. If all (by which I understand every particle) of the intercellular matter be removed, I doubt if the pulp would be fit for the manufacture of brown or any other paper, on account of the exceeding minuteness of the cellulose matter remaining; if so much of the intercellular matter be removed that the pulp while fine enough to make good paper has still the fibrous character, then it would be fit for the manufacture of brown paper.

X. 25. Have you ever made any experiments to ascertain the proportion of cellulose by weight fit for the manufacture of paper that can be obtained from wood, straw, or other similar vegetable substances?

A. I have not myself, because I have relied in such matters upon the statements of chemists who have made the requisite experiments.

X. 26. According to your understanding of the original Watt & Burgess' patent as given by you in your direct interrogatory 10, the "simple process referred to by you in your answer to direct interrogatory 12, as the first of the processes described in re-issued patent No. 1449, is not described in said original specification. Do I state your answer correctly?

A. I believe you do.

X. 27. Then it is your opinion, is it not, that if some one had boiled shavings of wood in a caustic alkaline solution of the strength indicated by 12° of the English hydrometer, in a close vessel capable of containing a pressure equal to that caused by a temperature of 300° or more in the alkaline solution, and thereby produced pulp, he would not have infringed the original Watt & Burgess' patent?

A. That is my opinion.

X. 28. If that specification had stated that pulp could be produced from chips or shavings of wood in a caustic alkaline solution of the strength stated in the last question, at a high pressure, would the condition stated in the last question be an infringement of such a patent?

A. Certainly not, unless the claiming clause confined the invention to the production of pulp by that one operation; if the specification had made a statement substantially such as is stated in the question, but had in addition stated that the invention consisted of a process
564 for making paper by treating wood-shavings with caustic alkali, chlorine simple, or its compound with oxygen and alkali in the order substantially as described, the person who only boiled the shavings of the wood in the alkaline solution, would not have infringed the invention.

X. 39. If the claim had included, or a separate claim had been invented so as to include, the production of pulp by boiling, in the two last questions, at a high pressure, would it not then have been an infringement?

A. If there had been a special claim to the production of pulp by boiling in the alkaline solution, as described, the person who should boil wood-shavings in the alkaline solution of the strength indicated, would have infringed upon the invention, whether he boiled them at a high or a low pressure, because, as I understand the description in the patent, boiling in the alkaline solution, at any pressure, is within that description.

X. 30. If Watt & Burgess, prior to the date of this English patent, had actually produced pulp suitable for the manufacture of paper from wood, by boiling chips or shavings of wood in a strong caustic alkaline solution, at a high temperature, would you not consider the specification of the original American patent, as you have stated the substance of it in your answer to direct interrogatory 10, defective and insufficient in not describing and claiming this result?

A. No, I should not; I should consider it as I now do, a description of a substantially different invention from that referred to in the question.

X. 31. In giving the last answer, do you assume the pulp obtained by the single operation and that which is the result of the process described by you in your answer to direct interrogatory 10, to be the same, or different?

A. I made no assumption as to the quality of the pulp; my answer was based upon the difference between the process or operation described in the 30th cross-question and the compound process described in the original Watt & Burgess patent.

X. 32. In giving the answer to your 30th cross-question, you had no regard, then, to the result sought to be obtained by either process, whether it was the same or different?

565 A. If the word "result" be used to mean the product of the process, I had no regard to it in giving my answer to the 30th cross-question; as I understood that question at the time, I understood the result referred to in the last part of the said question as meaning the process of producing pulp by the single operation of boiling the shavings in the strong caustic alkaline solution at a sufficiently high temperature for that purpose. If by the word "result" in that question be meant the product of the operation, I should still say that the original Watt & Burgess patent was not defective and insufficient in not describing and claiming a result that was obtained by a process substantially different from anything that is described in it. If the product obtained by the process described as the invention in the original Watt & Burgess patent were a product possessing new properties, then I think that Watt & Burgess would have had a right to have taken out a separate patent for such product, describing it by its properties or distinguishing characteristics, and they erred in not doing so.

X. 33. Then if the product was the same by the two processes, do you not think that they erred in not taking out a patent or patents for both processes, as well as for not taking out a patent for the product, supposing all them to be new and of their invention?

A. I think they did err, as by neglecting to do so they gave two of the three inventions to the public.

(The latter part of answer objected to.)

Adjourned to 10½ a. m. the 11th instant.

TUESDAY, *June 11th*, 1867.

Present, counsel for the respective parties.

Mr. Nye, for the complainant, states that they will not pursue the cross-examination of the witness further, inasmuch as the hour for taking testimony has expired, and further examination might delay the printing of the testimony, and the hearing of the cause.

Defendants' counsel states, that he yesterday stated to the complainants' counsel that he could proceed with the cross-examination of

566 the witnesses to-day, if he wished, and now, June 11th, 1867, at 11 a. m., tenders Messrs. E. S. Renwick and H. B. Renwick the witnesses for further cross-examination.

E. S. RENWICK.

Subscribed and sworn to before me this 11th June, 1867.

R. E. STILLWELL,
Examiner, &c.

567 Depositions of witnesses produced, sworn or affirmed and examined before Henry Phillips, jr., esquire, a commissioner of the United States in and for the eastern district of Pennsylvania, pursuant to an order of the said court constituting the said Henry Phillips, jr., esquire, a special examiner on the part of the defendant, at his office, No. 524 Walnut street, in the said city of Philadelphia, pursuant to notice hereto annexed.

PHILADELPHIA, *June* 10, 1867.

Present, George Harding, esq., counsel for the defendant; Henry E. Wallace, esq., counsel for the plaintiff.

(Mr. Wallace objects to the taking of all and every and any depositions under the above notice, on the ground that the proper notice of taking such depositions had not been furnished.)

HIRAM STANHOPE, a witness on the part of the defendant, being produced and duly sworn according to law, doth depose and say:

My name is Hiram Stanhope; am a little over 52 years of age; reside in Aramingo, Philadelphia; am a machinist and boiler-maker; am a member of the firm of Stanhope & Supplie.

(Drawing of a boiler, marked tracing of patent 38901, produced, Exhibit E, H. Phillips, jr., being shown to witness, and being asked if his firm constructed any boilers like that, and if so, how many, and when, and for whom?)

A. This is a tracing of the boiler such as we made; we constructed four; the order for them was given April 20, 1859; two were delivered June 25, 1859, and two June 28, 1859; they were built for J. & D. George; they were charged on our books to them; I knew they were paid for by them.

568 Q. Who furnished you the drawings to build them by?

A. Morris L. Keen.

Q. Were those boilers put to work; and, if so, how soon and have you ever seen them in operation, and where?

A. They were put to work as soon as they could be put up after they were delivered; just as soon as they could be put up; I have seen them in operation at Royers' Ford, and at the paper-mill of J. & D. George; they were put in operation within two or three weeks after they were delivered; just so fast as they could be put up.

Q. Did you manufacture and deliver the boiler with all appurtenances and fixtures, as shown in the drawing, or did you merely deliver the shell?

A. We furnished all except the steam-gauge here represented; we furnished these perforated screens, and the pipe and stop-valves marked "F," at the bottom; we furnished the parts marked "D" and "G."

Q. When you thought it was put in operation—what do you mean by that expression?

A. They were charged with wood and heated up and then blowed off after the wood was cooked, as they call it; it was blown off into what they called a blow-tank.

Q. How long, after delivery, was the first time you saw it in operation?

A. I don't recollect; it might have been a month or two months.

Q. Are you sure that it was in that year, 1859?

A. Yes, sir.

(Mr. H. E. Wallace objects, not having received proper notice, and cross-examines without waiving any of his objections or legal rights.)

Q. Do you speak of this from recollection entirely as respects date, order and delivery?

A. That is taken from our books.

Q. With whom did you make a contract for these boilers?

A. Morris L. Keen.

Q. What did you furnish under your contract?

A.

569 Q. Did you set those boilers up and put them in operation yourself?

A. No, sir.

Q. Were you furnished with drawings of each of the separate parts of those boilers?

A. Yes, sir. I was furnished with drawings of the stop-valves, that is, I was furnished with a sketch of them, from which I made drawings; the sketch of the screen was furnished to us as it is in this boiler.

Q. Was it in parts or in the whole that these boilers were delivered?

A. When we delivered the boilers the upper screens were fitted in the boiler before it left the shop; the lower pipe, with the stop-valve, was riveted at the bottom after the boiler was set up in its place.

Q. When you say that it was put in operation, what do you mean by that expression?

A. When they were charged with wood and heated up.

Q. Then you were requested by Mr. Keen, as an artisan in work of this kind, to make this boiler after plans submitted by him?

A. Yes, sir; Keen requested me to make it out; I think the Georges paid for it; it was paid for by the Georges; I know it was; I furnish you with a copy of the entries as follows:

"J. & D. George want four boilers, sixteen feet long, fifty-four inches in diameter, double riveted, made of three-eighths (⅜) iron.

"Two boilers delivered June 21st, and two delivered June 28th, 1859.

"Paid for by notes drawn by Jesse George in favor of J. & D. George. Notes received August 17th and 31st, 1859, at three months."

Q. Was this all in one entry in the book?

A. I am not certain about that; our clerk took them from it.

570 Q. Did you ever make any boilers for any one else similar to those?

A. No, sir. We have made for the American Wood-Paper Company within two (2) years; also by order of Mr. Keen; they were ten, just like the others, only larger.

Q. This entry of delivery in your book, does it indicate the setting up of the boilers and their completion, or merely the sending of them there?

A. That is the date they left the shop.

Q. Have you any recollections as to terms of payment?

A. There was nothing said about the payment; we are usually paid when the work is delivered; we had done a great deal of work for the Georges before, and they had always paid us?

Re-examined by Mr. Harding:

Q. When did you last see the boilers?

A. About two months ago I was up there, and one of them is in operation yet, but it has been altered; but it is heated by steam instead of fire.

Q. Have you seen these boilers from time to time, since 1859?

A. Yes. I have been going there off and on to the present time; three of them have been taken out for repairs; we are now repairing one at our shop, where it was burnt out, but it is to go back and be put up just as it was before.

Re-cross-examined by Mr. Wallace:

Q. You say, in your examination-in-chief, that those boilers were furnished to a paper-mill of J. & D. George. Do you know that J. & D. George were carrying on the mill at that time?

A. For anything I know they were. They paid for all the work that was done.

Q. Is that your reason for supposing so?

A. I understood the property belonged to them, and the machinery. It was afterwards owned by Ladd & Co.

Q. Who were Ladd & Co.? Who was the Co.?

571 A. I don't know any of them except Mr. Ladd. He resided in New York.

Q. Did you not see Mr. Keen there?

A. Yes, sir.

Q. Did Mr. Keen superintend the erection of the boilers?

A. Mr. Keen was manager at the works ever since I knew anything about it.

Q. At this time, in 1859, was he manager for J. & D. George, or for Ladd & Co.?

A. That I don't know. I don't know in what year Ladd & Co. took it.

Q. Did he manage for Ladd & Co. after they took it?

A. He was still there acting as manager, and always has been such.

Re-examined by Mr. Harding:

Q. Were the boilers in operation during your visits, in 1859, to the factory?

A. Yes; they were.

HIRAM STANHOPE.

Sworn to and subscribed this 10th day of June, 1867, before me.

HENRY PHILLIPS, JR.,
U. S. Commissioner.

ROBERT E. ROGERS, called as a witness for defendant, being duly produced and sworn according to law, doth depose and say:

(Mr. Wallace continues his objection as heretofore to the examination of any witness, on the ground of insufficient notice.)

1. Q. What is your name, age, residence, and occupation?

A. Robert E. Rogers. I am forty-nine. I reside in the city of Philadelphia. I am professor of chemistry in the University of Pennsylvania.

2. Q. Have you translated French scientific works?

A. I have participated in the translation of Gay Lussac's methods of gold and silver assaying in connection with minting matters.

572 (Objected to by Mr. Wallace; both question and answer.)

3. Q. Please translate the passage in the sixth volume of Dumas, Traité de Chimie Appliqué Aux Arts, 1843, vol. 6, page 16, article 3381?

A. I now furnish you a translation of it.

(Hereto annexed, marked Exhibit 63.)

4. Q. Have you tried any experiments to ascertain the effects of treating wood with a solution of caustic alkali at high temperature? If so, state the experiment, and produce any exhibit illustrating the result.

(Objected to.)

A. I have made the following experiment, to wit: 300 grains of poplar wood, in small slices, were treated with 1,500 grains of a solution of caustic soda, marking 12° of Beaumé or 17° of Twaddell, were put into an iron tube capable of holding 2,350 grains of water heated in a paraffine bath from 400° Fahrenheit to 480° Fahrenheit during four hours, the temperature being for the most part 480°. The tube was cooled and opened. There escaped some incondensable gas of strong odor

resembling methylic alcohol. The contents were poured out and examined. The solution was a deep black liquid with neither woody fibre nor pulp visible. The bottle here presented contains a specimen of the said contents.

(Bottle marked Exhibit 1, Rogers.)

The tube was hermetically closed during the operation, and the materials therefore were exposed to a pressure due to the temperature.

5. Q. Have you examined the original letters-patent of Watt & Burgess, July 18, 1854, Defendant's Exhibit 47, and the re-issued letters-patent of Ladd & Keen, annexed to complainant's bill, April 7, 1863, Exhibit "B," re-issue No. 1449, and do you understand the inventions therein described?

(Objected to.)

A. I have examined the said exhibits, and believe that I understand their language and intention.

6. Q. Please state whether or not you find in said re-issue No. 1449 any invention not contained in the original patent of 1854, Defendant's Exhibit 47, and whether or not the invention contained in the
573 re-issue No. 1449 is essentially different from that contained in the original patent of 1854, and give your reasons for the opinion.

A. I do find in said re-issue No. 1449 an invention not contained in the original patent of 1854, and that invention is essentially different from the one contained in the patent of 1854, and the following are my reasons for so stating:

In the patent of 1854 the process for paper-pulp making, as distinguished from bleaching, consists of three successive steps, in especial alternation with each other, as essential; in which a weak alkali is used to be boiled with the woody material, alternated with the treatment of the material by chlorine and the subsequent boiling of the material with the weak alkaline solution, in which operations pressure is in nowise essential as a feature. In the re-issue of 1863, the process for the making of pulp, as distinguished from bleaching, is a single step, or consists of a single step in which the use of the alkaline liquid of high strength and of high pressure is made of essential importance. The three-step process exhibiting this specific alternation in the use of the materials designated in the first-named patent, namely, of 1854, would not at all lead to or suggest the single-step process of the patent of 1863; but, on the contrary, would suggest to a chemical expert that nothing other than the three-step alternating process of the patent of 1854 would accomplish the result of producing pulp from wood, and therefore I regard the two as distinct inventions.

7. Q. Please examine Defendant's Exhibit 56, and state whether or not it is a correct extract from the Brêvet d'Invention of Sieur Gros, of March 20th, 1847, and whether or not you have verified translations of the passages contained there.

(Question objected to.)

A. Yes, sir; I have so examined and compared the exhibit, and find it correct, and the translation correct.

8. Q. Do you know the temperature at which hydrogen is evolved?

(Question objected to.)

A. By the testimony of Dumas, whose experiment is quoted by
574 Hoffman, in the report of juries of the English exhibition of 1862, it appears that when wood with the mixed alkalies is heated to a temperature beyond 485° hydrogen was evolved.

9. Q. In the first passage quoted from Gros's patent, would there be difficulty, and, if any, what, in preparing caustic solution of soda by the original description of Gros?

(Question objected to.)

A. In my opinion, there would not.

10. Q. State how you would do it.

(Question objected to.)

A. To prepare the solution described by Gros, I would use ten per cent. of the soda-ash to the water, making a solution of said soda-ash in the water, and treating said solution by five per cent. of good caustic lime, agitating the materials thoroughly together and decanting the supernatent liquid.

Cross-examined by Mr. Wallace:

1*. Q. To what extent are you practically acquainted with paper-making?

A. To the extent of having visited paper factories and studied in books on the subject, the details and process of the manufacture.

2*. Q. Have those visits and that study been recent or of old date?

A. They have been at intervals dating back twenty years to within the past nine months.

3*. Q. When did you make the experiments referred to in your answer to question four?

A. Within the past five days.

4*. Q. Have you made any other experiment on the same or similar materials; and, if so, when and how?

A. This is the only experiment of this specific kind that I have made, though I have experimented on paper-making materials, as a matter interesting me in science, at other times.

5*. Q. Did you open the tube during the operation?

A. I did not; but retained it closed from the beginning until the end.

575 6*. Q. What do you consider the substance produced by your experiment to be?

A. Without being able to say specifically what new compounds are produced by the original elements of the wood, I believe that the material exhibited is made up of several substances which have resulted from the destruction totally of the wood itself, and of the re-arrangement of the ultimate constituents of the wood into less compound products, this being in accordance with the testimony of chemists that when such organic substances as wood are heated to a very high temperature with alkalies.

7*. Q. How did you prepare the caustic alkali used in that experiment?

A. I did not prepare the alkali, but used that which was furnished by the firm of Powers & Weightman, bearing their label and stamp.

8*. Q. Was the strength indicated by them or ascertained by you?

A. The strength was not indicated by them, but was made use of in solution so dilute with water as to indicate the specific gravity of 17 Twaddell, English hydrometer.

9*. Q. How long prior to this experiment was it that you made any former experiments?

A. The last experiment I made prior to this one was two weeks ago.

10*. Q. When was your attention first called to the Watt & Burgess patents, to which you have alluded in your answer to question six?

A. Within the last fortnight.

Re-examined by Mr. Harding:

Q. 1. Have you examined the specimens on file in the Patent-Office in the matter of Watt & Burgess' application for a patent in 1854?

(Question objected to.)

A. I have examined four specimens in the Patent-Office so labelled.

Q. 2. Have you examined the report of experiments made by Dr. Rand, contained in table marked Exhibit B, annexed to Dr. Rand's testimony?

576 A. I have carefully inspected the table referred to. I did so before making my experiment.

Q. 3. Did you carefully examine the two specifications on which you gave your testimony-in-chief of Watt & Burgess, 1854, and the re-issue of Ladd & Keen of 1863?

A. I did carefully examine them.

(The foregoing depositions are agreed to be used in the present printed form, the same as though they had been written out, by the consent of the counsel interested.)

Q. 4. Have you examined the specimens of the vials in the possession of the clerk of the United States court? Have you examined four vials sealed up and marked L. D. G., C. J., E. F. Brown, on file in the United States circuit court at Philadelphia; and if so, state whether or not those specimens correspond with those which you found on file in the Patent-Office in the matter of Watt & Burgess' application for a patent in 1854?

A. I have examined the vials with their contents as specified, and do verify them as corresponding with those which I recently found on file in the Patent-Office, in the matter of Watt & Burgess' application for a patent in 1854.

Mr. Wallace specially objects to the question.

R. E. ROGERS.

Sworn to and subscribed this 10th day of June, 1867.

HENRY PHILLIPS, JR.,
U. S. Commissioner.

(Here follows diagram marked page 576.)

577 The U. States Patent-Office to all persons to whom these presents shall come, greeting:

This is to certify, that the annexed is a true copy from the records of this office of letters-patent granted Charles Watt and Hugh Burgess July 18th, 1854.

In testimony whereof I, D. P. Holloway, Commissioner of Patents, have caused the seal of the Patent-Office to be hereunto affixed this sixth day of May, in the year of our Lord one thousand eight hundred and sixty-three, and of the Independence of the United States the eighty-seventh.

[SEAL.] D. P. HOLLOWAY.

578 No. 11343.

The United States of America to all to whom these letters-patent shall come:

Whereas Charles Watt & Hugh Burgess, of London, England, have alleged that they have invented a new and useful improvement in the manufacture of paper from wood, which they state has not been known or used before their application; have made affirmation that they are subjects of the Queen of Great Britain; that they do verily believe that they are the original and first inventors or discoverers of the said im-

provement, and that the same hath not, to the best of their knowledge and belief, been previously known or used; have paid into the Treasury of the United States the sum of five hundred dollars, and presented a petition to the Commissioner of Patents signifying a desire of obtaining an exclusive property in the said improvement, and praying that a patent may be granted for that purpose.

These are therefore to grant, according to law, to the said Charles Watt & Hugh Burgess, their heirs, administrators, or assigns, for the term of fourteen years from the nineteenth day of August, one thousand eight hundred and fifty-three, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said improvement, a description whereof is given in the words of the said Watt & Burgess in the schedule hereunto annexed, and is made part of these presents.

In testimony whereof I have caused these letters to be made patent, and the seal of the Patent-Office has been hereunto affixed.

Given under my hand at the city of Washington this eighteenth day of July, in the year of our Lord one thousand eight hundred and fifty-four, and of the Independence of the United States of America the seventy-ninth.

ROBERT McCLELLAND,
Secretary of the Interior.

Countersigned and sealed with the seal of the Patent-Office.
[L. S.] C. MASON,
Commissioner of Patents.

579 The schedule referred to in these letters-patent & making part of the same.

To all whom it may concern:

Be it known that we, Charles Watt, of the city of London, in the county of Middlesex, & Hugh Burgess, of the city of London, in the county of Middlesex, and kingdom of Great Britain, have invented, made, and applied to use certain improvements in pulping and disintegrating vegetable substances for which letters-patent have been granted to us by Her Majesty, the Queen of Great Britain, bearing date the day of , one thousand eight hundred and , and we do hereby declare that the following specification (being the same on which letters-patent were granted) is a full, clear, and exact description of the same:

The wood or vegetable substances upon which it is intended to operate by this process should first be reduced to very fine shavings or cuttings, the finer the better. This may be done in any suitable machine.

The shavings are then to be boiled in a solution of caustic alkali, the strength of which, being dependent on the nature of the vegetable substance operated on, can only be learned by experience. For deal or fir-wood we find that a solution of alkali of the strength indicated by 12° of the English hydrometer answers very well. The length of time necessary for this part of the process is somewhat dependent on the nature of the vegetable substance to be treated. We find boiling in a solution of caustic alkali under pressure of considerable service.

580 We do not claim this operation as a part of our invention.

The shavings are then to be well washed and pressed, and the washing may be saved and evaporated down, & burned in a suitable furnace, when they are again available for the same purpose. The

damp shavings are now to be exposed to the action of chlorine, or the compound of chlorine with oxygen, till, on a portion being placed in a dilute solution of caustic alkali, the vegetable substance falls into a dark, pulpy mass.

This part of the process is conveniently effected by placing the damp shavings on racks or drawers about nine inches apart, one above another, arranged in a chamber, and allowing the chlorine, or the compounds of chlorine with oxygen, to enter the chamber and fill it. Of the compounds of chlorine with oxygen we prefer that known as protoxide of chlorine, or hypochlorous, or chlorous acid, or euchlorine.

If found more convenient, the chlorine, or the compounds of chlorine with oxygen, may be used in aqueous solution instead of the gaseous form. As soon as the shavings have been sufficiently acted upon by the gas, as may be ascertained by the method above described, they may be removed, and the hydrochloric acid, which is the result of the above process, removed by washing, and the shavings well pressed. This should be done with as little water as possible, as this acid may be saved, and made use of for the reproduction of chlorine.

The shavings are now to be placed in a weak solution of caustic alkali, when they will fall into a pulpy mass of a dark-brown color.

581 This part of the process may be expedited by exposing this mass to the action of a beater, or "engine" placed in the tank containing the solution of alkali.

The pulp obtained as above described having been freed from the alkali by washing, which (may be saved as before directed,) may now be bleached by the usual process, or, as we prefer, by chlorite or hypochlorite of soda or potash, liberating the chlorous or hypochlorous acid by hydrochloric acid.

Having thus fully described the nature of our invention, and shown how the same may be reduced to practice, we wish it to be distinctly understood that we do not confine our claim to the apparatus or utensils, or the manipulations herein named, as they may be varied to suit the circumstances of the case.

But what we do claim as of our invention, & desire to secure by letters-patent, is the pulping and disintegrating of shavings of wood and other similar vegetable matter for making paper by treating them with caustic alkali, chlorine simple, or its compound with oxygen, and alkali, in the order substantially as described.

In witness whereof we have hereunto set our signature this sixth day of January, in the year one thousand eight hundred and fifty-four, in the presence of two subscribing witnesses.

CHARLES WATT.
HUGH BURGESS.

Witnesses:
WILLIAM LEWIS,
8 *St. Alban's Terrace, Kennington.*
JOHN WATT, 1 *Ampton street, Gray's Inn Road.*

(Indorsed:) Patent to Watt & Burgess, July 18, 1854. From 19 Aug't, 1853. Defendants' Exhibit D. K. G. W., examiner. Filed May 21st, 1867.

582 DEFENDANTS EXHIBIT T.—C. W. NEWTON, *U. S. Examiner.*

EDINBURGH, *February 7th*, 1846.

DEAR SIR: Having had several opportunities of seeing your operations at Chalford during the last two years, and having become ac-

quainted generally with the mode of manufacture of paper from straw as there carried on, I should be very glad if any opinion of mine as to these and the general results were of any service to you.

I therefore feel it a duty to state that I am satisfied that those who may adopt your process in favorable circumstances, and with good management, must find it successful and remunerative, and it is not unlikely that the advantages which the process affords will eventually displace in a great degree the mode of manufacture now pursued; for, in every department of expense, whether as respects the material, the mode of preparing and working it, and the comparatively small power
583 required, together with the inexhaustible supply of the material at a time when the usual substances are so scarce, unquestionably places you and your patent in a highly favorable position to supply paper of equal quality at a greatly lower rate than it is possible to do from rags.

I remain, dear sir, very truly, yours,

CHA'S COWAN.

L. W. WRIGHT, Esq'r, *Chalford.*

(Indorsed:) Defts' Exhibit T. Lemuel W. Wright's deposition, June 8th, 1867.

DEF'TS' EXHIBIT, 1.—K. G. W., *Ex'r.*

[COAT OF ARMS.]

A. D. 1792.] [No. 1922.

Specification of Hector Campbell.—Paper.—Filed May 21st, 1867.—Price 4d.

584 [Patent stamp, fourpence, canceled, and coat of arms.]

A. D. 1792.] [No. 1922.

Paper.—Campbell's specification.

To all to whom these presents shall come, Hector Campbell, of the parish of Saint Mary Magdalen, Bermondsey, in the county of Surrey, Chymist, sendeth greeting:

Whereas His present most excellent Majesty King George the Third, by his letters-patent under the great seal of Great Britain, bearing date at Westminster, the twenty-eighth day of November, in the thirty-third year of his reign, did give unto me, the said Hector Campbell, his especial licence that I, the said Hector Campbell, during the term of fourteen years therein expressed, should and lawfully might make, use, exercise, and vend, within that part of His said Majesty's kingdom of Great Britain called England, his dominion of Wales, and town of Berwick-upon-Tweed, my invention of "An improved method of destroying and taking away all the carbonic, oleaginous, and colouring elements and particles in linen, cotton, hemp, and in all coloured rags and other materials used in making paper, in a manner hitherto unattempted in this kingdom, and at a much less expence than any method now in use;" in which said letters-patent there is contained a proviso obliging me, the said Hector Campbell, to cause a particular description of the nature of my said invention, and in what manner the same is to be performed, by an instrument in writing under my hand and seal, to be inrolled in

His Majesty's high court of chancery within one calendar month next and immediately after the date of the said recited letters-patent, as in and by the same (relation being thereunto had) may more fully and at large appear:

Now know ye, that in compliance with the said proviso, I, the said Hector Campbell, do hereby declare that my said invention of an
585 improved method of destroying and taking away all the carbonic, oleaginous, and colouring elements and particles in linen, cotton, hemp, and in all coloured rags and other materials used in making paper, in a manner hitherto unattempted in this kingdom, and at a much less expence than any method now in use, is described in manner following, (that is to say):

I, the said Hector Campbell, having practised and still practising, under circumstances, the method invented by the French (which I believe I first adopted for absolute business in England) of saturating a tub of water, or any other fit receiver, with oxygenated muriatic acid, and applying this liquid to a variety of bleachable articles. In the year one thousand seven hundred and ninety-one I took it up as a manufactory, and applied it to whitening coloured, brown, Hambro', and other cheap rags, both whole and in a reduced state, for the purposes of selling rags, pulp, and other materials for making paper; but notwithstanding the previous use of an alkaline ley, and when the liquor was put to the article, the revolution of the vessel and the variety of plans to excite internal motion, such as sticks to catch and divide internal revolving and up-and-down powers, and levers to agitate and divide, all of which I practised, I still found the operation in preparing the said materials for making paper (in point of time, labor, inequality of beauty and bleaching, only to a certain degree) extremely imperfect. Therefore, from numerous considerations and experiments, and at a great expence of time, labour, and money, I discovered the following improved method:—Take of rag, coloured or not, or pulp, or any cotton, flaxen, hempen, or other material fit to make paper, and let the first consideration be for what purpose you want it, that is, how valuable you intend to make the article. Wash the said material for making paper. When the material for making paper is wanted for making an inferior sort of paper, it don't require to be passed through an alkaline ley previous to bleaching, but may be bleached in the manner hereinafter described. Should the material be wanted for making better paper, it may be passed through an alkaline ley, cleansed from it, and then bleached in manner hereinafter described; but this process of previously passing the material for making paper through an alkaline ley will not bleach in once bleaching beyond a certain degree extremely inadequate to constitute superior excellence. Therefore, to bleach the material in the best manner, take of either of the said materials for making paper, and either pass it through an alkaline ley previously or not, then bleach it in the manner hereinafter described, then boil it in an alkaline ley; a solution of caustic potash will answer the purpose. The time of boiling and the strength of the ley must be adjnsted by the nature and quality of the material and the purpose it is wanted for; then wash the
586 alkali from the material, and present it again to be bleached.

This process will be found sufficient, but to bring the material to a greater perfection it may be repeated alternately; but after the material has been alkalised, passing it through or having anything to do with what are termed the sours, or vitriolic acid and water, or any other acid and water, is unnecessary. Fine materials for making paper is considerably improved by bleachiug, and then boiling in alkali, and

then bleaching again; but more especially coarse white or brown materials, such as have never been coloured, will never so well have their carbonic, oleaginous, and ligneous elements and particles (with which they abound) done away, or be brought to any state of perfection, without the above process of bleaching and boiling. The vessel or receiver for bleaching the material in may be of any shape or dimension, and made of any substance capable of compression and condensation. I do it in receivers made of wood, in glazed earthen vessels, and other vessels, of any shape or dimension; and, indeed, it may well be done in any receiver the substance of which is devoid of oil and metal, and not subject to be materially affected by the oxygen or acid. The quantity of materials to be bleached should contain about its own weight of water, the superabundant quantity of water being pressed out. The material must then be opened by a machine called by the cotton manufacturers a devil, or some machine of that nature. Then distribute the material in the receiver thinly on one or more frames or layers, placing them so as not to come in contact with each other, or the material may be placed in the body of the receiver, and turned round in it, so as that the bleaching power may have a free communication with all parts of the material. Then close the receiver; make one or more holes or apertures in the side or other part of the receiver of a sufficient size to admit the end or mouth of a retort; then get one or more retorts or other proper vessel, put therein a substance containing oxygen or vital air, which may be found in many substances besides manganese; but as manganese particularly abounds with oxygen, and therefore a quantity of it is ready made by nature, take of manganese (such as contains the most oxygen) a third part of any given quantity, and mix it with a proportion of two-third parts of marine or sea salt; but this proportion must be governed by the aerated state of the manganese; mix them well together previous to their being put into the retort, and with the manganese and sea salt so mixed put in sulphuric or vitriolic acid of a quantity equal to or rather more than the sea salt; then join the neck or mouth of the retort with the receiver, and lute it, or if the retort is tubulated you may join it to the receiver and lute it before it is charged, as aforesaid. The number of retorts to be applied cannot be ascertained, as they will depend on the size of the receiver and the quantity of material put in to be bleached.

587 The retorts should rest on sand kept continually heated for working, or heat otherwise sufficiently communicated would do. The bleaching will now commence, which should be continued until the material is sufficiently whitened for the purpose wanted, which may be known by looking at it; then take it out, and add more material to be bleached in the same manner, and so on, again charging the retort, in manner aforesaid, strong enough to proceed, taking care that the material to be bleached shall never wait for the bleaching power, nor the bleaching power to be played upon a material which is no longer bleachable; and the material thus bleached, being emerged and washed in water to take away the acid contained in it, becomes fit to be applyed for the purpose of making paper, and may be proceeded on accordingly.

In witness whereof, I, the said Hector Campbell, have hereunto set my hand and seal, this twenty-second day of December, in the thirty-third year of the reign of our sovereign lord George the Third, by the grace of God of Great Britain, France, and Ireland king, defender of the faith, and so forth, and in the year of our Lord one thousand seven hundred and ninety-two.

HECTOR CAMPBELL. [L. S.]

Sealed and delivered by the above-named Hector Campbell (being first duly stamped) in the presence of—

WILLIAM BULL,
CHA'S HUMPHREYS,
St. John's, Southwark.

EDW. MONTAGU.

And be it remembered, that on the twenty-eighth day of December, in the year above mentioned, the aforesaid Hector Campbell came before our lord the King in his chancery, and acknowledged the specification aforesaid, and all and everything therein contained, in form above written. And also the specification aforesaid was stamped according to the tenor of the statute in that case made and provided.

Inrolled the same twenty-eighth day of December, in the year above written.

London. Printed by George Edward Eyre and William Spottiswoode, printers to the Queen's Most Excellent Majesty. 1856.

DEF'TS' EXHIBIT 2.—K. G. W., *Ex'r.*

[COAT OF ARMS.]

A. D. 1794.] [No. 2026.

Specification of William Cunningham.—Manufacture of paper.—Filed May 21st, 1867—Price 4d.

588 [Patent stamp, four pence, canceled, and coat of arms.]

A. D. 1794.] [No. 2026.

Manufacture of paper.—Cunningham's specification.

To all to whom these presents shall come, I, William Cunningham, of the city of Edinburgh, chemist, send greeting:

Whereas His most excellent Majesty King George the Third, by his royal letters-patent under the great seal of Great Britain, bearing date at Westminster, the twenty-eighth day of November, in the thirty-fifth year of his reign, upon the petition of me, the said William Cunningham, has given and granted unto me, and my executors and assigns, His Majesty's especial licence, full power, sole privilege and authority, that I, the said William Cunningham, my executors, administrators, and assigns, and every of them, by myself or themselves, or by mine or their deputy or deputies, servants, or agents, or such others as I, the said William Cunningham, my executors, administrators, or assigns, should agree with, and no others, from time to time and at all times thereafter during the term of years therein specified, should and lawfully might make, use, exercise, and vend, within that part of His Majesty's kingdom of Great Britain called England, his dominion of Wales, and town of Berwick-upon-Tweed, my invention of "a method by which in the manufacture of paper-rags, known by the name of grays and ropes can be made into tea-crown paper, and rags known by the

names of tea-crown and bible-crown rags and thirds, can be made into paper called pot, small post, demy, royal inferior, or papers of similar qualities, and rags denominated seconds into paper called fine imperial, royal, super royal, writing royal, and medium, writing demy, thick post, thin post, fine foolscap, and all other papers which have been hitherto reckoned of the finest qualities, and by which paper can be made from fine rags of a finer and more beautiful quality and colour than was ever before manufactured," in such manner as to me, the said William
589 Cunningham, my executors, administrators, and assigns, or any of them, should in our discretion seem meet, and that I, the said William Cunningham, my executors, administrators, and assigns, should and lawfully might have and enjoy the whole profit, benefit, commodity, and advantage, from time to time coming, growing, and arising by reason of the said invention, to have, hold, exercise, and enjoy the said licence, power, privileges, and advantages thereinbefore granted or mentioned to be granted unto me, the said William Cunningham, my executors, administrators, and assigns, for and during and unto the full end and term of fourteen years from the date of the said letters-patent next and immediately ensuing, and to be compleat and ended according to the statute in such case made and provided; in which said recited letters-patent there is contained a proviso obliging me, the said William Cunningham, by an instrument in writing under my hand and seal, to cause a particular description of the nature of my said invention, and in what manner the same is to be performed, to be inrolled in His Majesty's high court of chancery, within one calendar month next and immediately after the date of the said recited letters-patent, as by the same, relation being thereunto had, may more fully and at large appear.

Now know ye, that in compliance with the said provisoe, I, the said William Cunningham, do hereby declare that my said invention is, and is performed, as follows, that is to say:

I make a particular alkaline ley of the proportion of materials as follows, vizt:—I take eight pounds of pearl-ashes and sixty-eight pounds of quicklime, and put them into a vessel with one hundred and twenty gallons of pure water. This mixture I stir six times a day for eight days, and then allow it to subside, and when the water is clear I run thirty English gallons through a flannel bag, to prevent any of the particles of the lime that may remain in the water from injuring the pulp or rag when it is boiled with the ley in the copper. This proportion of this particular ley is sufficient to boil five stones of fron weight of pulp or rag, with the addition of as much water as will make it boil easily. But before the pulp or rag & water is put into the copper there must be a false bottom made of wood, bored full of small holes, and fixed to the bottom of the copper to prevent the stuff from settling down upon the bottom of the copper, which would burn it. The boiling must be continued for three hours and a half; but if the shews or parts of the stems of the lint are very strong, the boiling ought to be continued double that time, or even more, and during the time of boiling it must be frequently stirred. After the boiling operation is over, the contents of the copper must be run into a drainer, and as soon as it can be lifted, it must be put into a washing engine for half an hour. It is after this put again into a drainer, and allowed to remain until the water, without pressure, is drained out of it; but if the rag or pulp is very
590 coarse, such as the brown Hamburgh, as much water must be allowed to remain as one-fourth of its own weight, or perhaps less if the stuff sticks too closely together. The said quantity must be put into a steam-chest or any vessell that will contain gass; but the

most convenient for the above quantity I have found to be a square box, three feet three inches by twenty seven inches deep, in which there must be four or five moveable wooden grates, at equal distances, to keep the layers of the stuff separate. The top of the box must be tightly luted down, to prevent the gass from flying off. Into this chest or box there is a lead pipe fixed, to be connected with the neck of a retort, which retort may be made of lead, glass, or any other material fit for the purpose. Into this retort I put the following materials, vizt, two pounds of manganese and three and a half pounds sea salt, which must be well mixed together with the hands, so as to make the particles adhere to one another as close as possible. The retort I put into a sand bath, the retort being tubulated; I then lute the end of the aforesaid pipe to the neck of the retort, and also the head. Previous to these materials being put into the retort, I take four pounds of vitriol or sulphuric acid and an English quart of water, which I mix gently together, and allow it to stand till it is cool. This cool mixture I pour into the retort, and stir it well with a small stick to mix the acid and materials together, and then I lute the stopper quite close. From this moment the bleaching power begins to operate, and in this situation the retort is allowed to stand for an hour, after which a gentle heat is applied for three hours, and then encreased till the contents are brought to boil. In this situation the retort remains till all the gass is wrought off, which may be in ten or twelve hours. This can be easily ascertained by taking out the stopper, and if there is no smell when you bring your head close to the hole of the stopper, the gass is all evaporated, and the retort may then be taken off and the contents poured out, care being taken that the current of air do not carry the smell of the residuum against the person employed. The lid of the steam-chest is now taken off, and the chest run full of water, in order to destroy the said smell of the gass in the stuff, which it will effectually do in about ten minutes. The water is then run off by a plug at the bottom, and the stuff allowed to drain for a little. It is then again put into the washing machine or engine, where it continues three-quarters of an hour, and is then run into the drainer, after which it is again put into the copper with the same proportion of the ley and water, and boil and stir it as before. After said boiling operation is over, the contents are again run into a drainer and managed in the same manner as already described, after which it is again put into the steam-chest and the retort set agoing, with the materials as before mentioned, or with the following materials, as the nature of the rag or stuff may require, vizt:—Two pounds of sulphuric
591 acid mixed with an English quart of water (more or less, but this I have found to be the best proportion,) five pounds of muriate of lime, and two pounds of manganese. The muriate of lime must be finely pounded, sifted, and well mixed with the manganese before it is put into the retort, and when the retort is wrought off, the steam-chest is again filled with water to destroy the smell of the gass as before, and the pulp, rag, or half stuff is then put into the beating-engine, and finished off for paper. If, from the coarseness of the rag and fineness of the paper wanted, it appears that the pulp, rag, or half-stuff is not sufficiently whitened, and the shews destroyed, the last operation must be again repeated, with either the first preparation of materials for the retort, or with the last, as may appear most advantageous in the opinion of the operator. But if the shews, pobs, or parts of the stem of hemp or flax still remain strong, this third operation must be conducted in the following manner, vizt:—Put the stuff again into the copper with the proportions of the same ley and water as be-

fore, and the boiling must be continued until they are destroyed; then prepare the stuff for the steam-chest as formerly, and charge the retorts with the following proportions of materials. Take four pounds of sulphuric acid, diluted with an English quart and fourth part of water, two pounds of sea salt, three pounds of the muriate of lime, two pounds of manganese; mix all these well together, and set the retorts agoing as before. When they are wrought off, the stuff must be managed as in the second operation. If coloured or printed rags are to be made into paper, the half-stuff must be submitted to the action of a weak sour, made of sulphuric acid and water, for four hours, and then washed before it is put into the copper to be boiled with the ley. This sour destroys the particles of iron contained in printed cloths, which, if allowed to remain, render the bleaching process imperfect.

As this and all chemical processes may be varied much, and to advantage, by the judgment of the operator, and as I may still, from experience, make further improvements, that the public may reap the advantage of them, my operations may be seen at all times at the places where they are carried on.

In witness whereof, I, the said William Cunningham, have hereunto set my hand and seal, this tenth day of December, in the thirty-fifth year of His Majesty's reign, and in the year of our Lord Christ one thousand seven hundred and ninety-four.

[L. S.] W. CUNNINGHAM.

Signed, sealed, and delivered (being first duly stamped) in the presence of us,

CRAUFAURD TAIT.
THO. YOUNG.

592 Craufurd Tait, of the city of Edinburgh, esquire, one of the clerks to His Majesty's signet in Scotland, maketh oath and sayeth that he, this deponent, was present, and did see William Cunninghame, of the city of Edinburgh, chemist, sign, seal, and as his act and deed deliver the deed-pole or instrument hereunto annexed, purporting to be a specification or description of a new invention, for which he has obtained His Majesty's royal letters-patent under the great seal of Great Britain, intended to be enrolled in His Majesty's high court of chancery; and that Thomas Young, of the parish of Cuthberts, in the county of Edinburgh, esquire, was also present, and did see the said William Cunninghame sign, seal, and deliver the said deed-pole or instrument; and that the name William Cunninghame set and subscribed to the said deed-pole or instrument is the proper handwriting of the said William Cunninghame, the patentee; and the name Thomas Young, set and subscribed on the the said deed-pole as one of the witnesses to the said William Cunninghame's signing, sealing, and delivering the same, is the proper handwriting of the said Thomas Young; and that the name Craufurd Tait, set and subscribed as another of the witnesses thereto, is the proper handwriting of this deponent.

CRAUFURD TAIT.

Sworn before me, one of the baillies or magistrates of the city of Edinburgh, and one of His Majesty's justices of the peace in and for the county of Edinburgh, this tenth day of December, in the year one thousand seven hundred and ninety-four.

WALTER LOTHIAN, *B. & J. P.*

And be it remembered, that the specification aforesaid was stamped according to the tenor of the statute in that case made and provided.

Inrolled the thirteenth day of December, in the year above mentioned.

London: Printed by George Edward Eyre and William Spottiswoode, printers to the Queen's Most Excellent Majesty. 1856.

DEF'T'S EXHIBIT 3.—K. G. W., *Ex'r.*

[COAT OF ARMS.]

A. D. 1800.] [No. 2449.

Specification of John Turnbull, junior.—Cleansing and bleaching fibrous materials.—Filed May 21st, 1867.—Price 4d.

593 [Patent stamp, four-pence, canceled, and coat of arms.]

A. D. 1800.] [No. 2449.

Cleansing and bleaching fibrous materials.—Turnbull's specification.

To all to whom these presents shall come, I, John Turnbull, junior, of Cordale Printfield, in the county of Dumbarton, North Britain, calico printer, do send greeting:

Whereas His most excellent Majesty King George the Third, by his letters-patent under the great seal of Great Britain, bearing date at Westminster, the fifteenth day of November, in the forty-first year of his reign, did give and grant unto me, the said John Turnbull, my executors, administrators, and assigns, his especial licence, full power, sole priviledge and authority, that I, the said John Turnbull, my executors, administrators, and assigns, during the term of fourteen years therein mentioned, should and lawfully might make, use, exercise, and vend, within that part of His said Majesty's Kingdom of Great Britain, called England, his dominion of Wales, and town of Berwick-upon-Tweed, my invention of "certain new processes or improvements of processes and apparatus applicable to the bleaching or whitening, and to the purifying, washing, and cleansing of cotton, flax, hemp, silk, and wool, and also applicable to the bleaching or whitening, and to the purifying, washing, and cleansing of goods of every description made or manufactured of cotton, flax, hemp, silk, and wool, or of mixtures of all or any of the above materials, and to other purposes, by which a considerable saving will be effected in the expence of fuel, alkali, and other matters or things employed in bleaching, or whitening, purifying, washing, and cleansing goods and apparel of every description;" in which said letters-patent there is contained a proviso, obliging me, the said John
594 Turnbull, particularly to describe and ascertain the nature of my said invention, and in what manner the same is to be performed, by an instrument in writing under my hand and seal, and cause the same to be enrolled in His Majesty's high court of chancery, within six calendar months next after the date of the said letters-patent.

Now know ye, that I, the said John Turnbull, in compliance with the said proviso, do hereby describe and ascertain the nature of my said invention, and in what manner the same is to be performed, videlicet:

I take cotton, flax, hemp, silk, or wool, or goods of any description made or manufactured of cotton, flax, hemp, silk, or wool, or of mixtures of all or any of the above materials that are wished or intended to

be bleached or whitened, and first cleanse, wash, or purify them from the loose dirt and foreign matter that may be adhering to them or mixed in their fixture, as also from the paste or other dressing that may have been used in their manufacture, (when the article or articles to be bleached or whitened are in a manufactured state,) which washing, cleansing, or purifying I effect by any of the common processes usually known and followed, as by steeping them in water, either hot or cold, or in any convenient aqueous solution, for about twelve hours, more or less, according to the quantity and quality of the goods, and afterwards mill-washing them or otherwise cleansing them from such impurities or dirt as can be removed by this or any similar means. By this washing, cleansing, or purifying, the goods are brought into a state more fit for the application of my new method of bleaching or whitening than if subjected to it, which they may also be without that previous cleansing; when thus cleansed, they are put into a lye of vegetable or of mineral fixed alkali, or of the volatile alkali, either mild or made caustic by quick-lime, or into a lye of quick-lime only, or into a soapy lye, or into a lye composed of all or any of those substances, (with or without the addition of oxygenated muriatic acid,) of a strength fit for the purpose of extracting the colourless, gummy, resinous, or other impurities which may exist naturally in or which may have been introduced (by accident or design) into the fibre or texture of the materials or goods under process, and which are too intimately united with them to admit of being removed by the first above-described washing or cleansing. The alkaline, soapy, or other lye may be prepared by the method or methods usually followed by bleachers, my invention not consisting in the kind of alkaline lyes or other liquors employed, or in the way of preparing them, but in the mode of applying such alkaline, soapy, or other lyes, (and in the accompanying and subsequent manipulations.) For when the goods or articles to be bleached are immersed in the alkaline, soapy, or other lye or liquor, as before directed, instead of boiling or bucking them in it, as is the practice usually followed, I only steep them or keep them long enough in the said lye to be thoroughly impregnated with it, which requires a shorter or longer time, according to the quantity and texture of the articles or goods. The goods are then drawn out upon a rack over the vessel in which they were impregnated, and suffered to drain, that the superficially adhering lye or liquor may run from them back into the said vessel. After this draining, the goods will still hold a sufficient quantity of the lye or liquor employed to answer the end in view. They are then put into a vessel of sufficient strength and dimensions, made of wood, stone, brickwork, earthenware, metal, or any proper material. This vessel, which I call the steaming-vat, may be almost of any form convenient for the premises or place where it is to be fixed, and is connected by means of a pipe, tube, hose, trunk, or hollow prism, made of wood, metal, or of any fit material, with a boiler, kettle, or cauldron, which I call the steaming-kettle, and which may be of any convenient form and dimensions. The tube above mentioned may pass from any part of the edge or of the side of the steaming-kettle, or even from its cover, which ought to fit steam-tight, into any part of the side or bottom of the steaming-vat, the intention and use of it being to convey steam from the aforesaid kettle to the aforesaid vat. The tube, pipe, hose, trunk, or hollow prism is furnished with a stop-cock or valve, or any contrivance what will answer the purpose of shutting and opening at pleasure the communication between the said kettle and vat. The steaming-vat ought, for the convenience of lifting out the goods, to be furnished with a false bottom

of some kind in the inside, as of wood or of net-work, for the goods to lye upon, and to this false bottom should be attached ropes by means of which and the assistance of a crane and pully, or any other convenient mechanical power, the goods may be withdrawn from the vat after the operation of steaming the goods. The operation of steaming the goods is performed by opening the communication between the steaming-kettle and steaming-vat, the former, which contains some water or aqueous solution, being kept at a proper heat by means of a fre put under it, and the latter having previously its cover fitted on steam-tight. The steam is thus, as it were, pent up in the kettle and vat, and made to act with any pressure that may be desired, or that the strength of the vessels may be able to sustain. To secure the safety of the people employed, the apparatus ought always to be furnished with a safety-valve attached to any part of the steaming-kettle or of the steaming-vat, or of the tube of communication, that when the elastic force of the enclosed steam reaches a determined point, the valve may open of itself and allow a portion of it to escape. By this process the goods can be heated considerably above the boiling-point, a circumstance that adds so much to the dissolving power of the alkaline or soapy or other lye, that the quantity left in the goods after draining, as before described, is found sufficient to dissolve and discharge, by one steaming, as much of the resinous, gummy, or other impurities from the goods under process as could have been discharged by a long boiling of the goods in the lye itself, as is the usual practice; and by this means a great saving is made in the alkalies and other ingredients employed for whitening the goods. For, in the common method, the colouring-matter as discharged from the fibre or texture of the goods is diffused throughout the whole lye, which soon renders it so foul that it is obliged to be changed long before it has become saturated with the substances or matters on which it exercises its power. But by my process or processes there is no more lye employed for one steaming than what is sufficient merely to impregnate the goods thoroughly, and the alkali, thus deposited in the texture or fibre of the goods under process, is more or less disengaged from the said texture or fibre by the action of the steam, and is found at the bottom of the steaming-vat of a dark colour, occassioned by the matters it has dissolved and carried down with it. The steaming-vat may be very commodiously freed from this deposit by a common stop-cock, or even a plug at or near its bottom, to be opened as often as may be necessary.

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I also effect the same end by using only a deep boiler, with a steam-tight cover, and suspending the goods previously impregnated with the alkaline, or other lye, as before directed, on frame or net work over boiling water in the said boiler, and employing oxygenated muriatic acid, acidulated waters, mill-washing, or exposure to the sun and air; when these may be necessary, particular care must be taken to keep a supply of water or some aqueous solution in the lower part of the boiler below the frame or net work on which the goods lye, or otherwise they may be singed, or actually burnt, and a loss be consequently incurred; but I prefer putting the goods in steaming-vats to putting them in a boiler in the manner just described, and that on several accounts, but especially because, by means of one steaming-kettle, steam can be thrown into as many vats as can conveniently be ranged 'round it, which is a mean of making a considerable saving in the article of fuel. One steaming generally requires from four to eight hours, but the length of time will vary according to the kind or quality of the goods to be whitened and the strength of the lye that has been employed for

impregnating them. After the steaming has been continued a sufficient length of time, the cover of the steaming-vat is taken off. The communication with the steaming-kettle is cut off by means of the aforesaid cock or valve provided for that purpose, and the goods are lifted out by means of a crane and pully, or other fit mechanical power,
597 as before mentioned. They are then well washed by milling, or by any of the processes followed by bleachers. After this they are again impregnated with lye, steamed, and then washed, and these manipulations are repeated, in the manner that has already been described, till the goods are brought to the required degree of whiteness and purity. The usual operations of steeping in acidulated waters and exposure to the sun and air, or to the action of the oxygenated muriatic acid in such stages of the process as the bleacher may think proper, may be employed with advantage in my method as well as in the common and usual method of bleaching. I need hardly direct here what every bleacher's own experience must point out to him, namely, that when acidulated waters, exposure to the sun and air, or the oxygenated muriatic acid are to be employed after any steaming, the goods should first be washed. When silk, sheep's wool, or goods containing sheep's wool, or animal hair, or furr of any kind are wished to be cleaned, scoured, or whitened by the above-described method, the lye employed ought to be much weaker than in the case of cotton, flax, or hemp, or of goods manufactured of these or any of them, for a strong caustic lye would entirely destroy the former, and convert them into a sapponacious matter.

In witness whereof, I, the said John Turnbull, junior, have hereunto set my hand and seal, this first day of May, one thousand eight hundred and one.

[L. S.] JOHN TURNBULL, JUN'R.

Signed and sealed, being first duly stamped, in the presence of—
JAMES HALL.
ANDREW MITCHELL.

This is the deed-poll referred to by Andrew Mitchell in his affivavit, sworn at Glasgow, this fourth day of May, in the year of our Lord eighteen hundred & one, before me.

JOHN HAMILTON,
Provost & Chief Magistrate of Glasgow.

Andrew Mitchell, of the city of Glasgow, in that part of Great Britain called Scotland, notary public, maketh oath that he was present, and did see John Turnbull, junior, of Cordale Printfield, sign, seal, and, as his act and deed, acknowledge and deliver, a certain deed-poll or instrument in writing hereunto annexed, bearing date the first day of May, instant, proporting to be a specification to describe and ascertain the nature of the said John Turnbull, junior's, invention of certain
598 new processes or improvements of processes and apparatus applicable to the bleaching or whitening, and to the purifying, washing, and cleansing of cotton, flax, hemp, silk, and wool, and also applicable to the bleaching or whitening, and to the purifying, washing, and cleansing, of goods of every description made or manufactured of cotton, flax, hemp, silk, and wool, or of mixtures of all or of any of the above materials, and to other purposes, by which a considerable saving will be effected in the expense of *feual*, alkali, and other matters or things employed in bleaching or whitening, purifying, washing, and cleansing

goods and apparel of every description; and this deponent further saith that the name or character "John Turnbull, jun'r," set at the foot of the said deed-poll as the party executing the same, is of the proper handwriting of the said John Turnbull, junior; and this deponent farther saith that the names "Andrew Mitchell," "James Hall," set and subscribed at the back of the said deed-poll or instrument as the witnesses to the signing and sealing of the said deed-poll, are of the proper respective handswriting of this deponent and of James Hall, of the city of Glasgow aforesaid, gentleman.

ANDREW MITCHELL.

Sworn at Glasgow, the fourth day of May, one thousand eight hundred and one, before me.

JOHN HAMILTON,
Provost & Chief Magistrate of said City.

Inrolled the ninth day of May, in the year above written.

London: Printed by George Edward Eyre and William Spottiswoode, printers to the Queen's Most Excellent Majesty. 1856.

DEF'T'S EXHIBIT 4.—K. G. W., *Ex'r.*

[COAT OF ARMS.]

A. D. 1801.] [No. 2481.

Specification of Matthias Koops.—Manufacture of paper.—Filed May 21st, 1867.—Price 4d.

599 [Patent stamp, four pence, canceled, and coat of arms.]

A. D. 1801.] [No. 2481.

Manufacture of paper.—Koop's specification.

To all to whom these presents shall come, I, Matthias Koops, of James street, in the parish of Saint Margaret, Westminster, in the county of Middlesex, gentleman, send greeting:

Whereas His present Majesty was graciously pleased to grant unto me, the said Matthias Koops, letters-patent, under the great seal of the United Kingdom of Great Britain and Ireland, bearing date at Westminster, on or about the seventeenth day of February, in the year of our Lord one thousand eight hundred and one, by which said letters-patent His said Majesty did give and grant unto me, the said Matthias Koops, my executors, adm'ors, and assigns, his special licence, full power, sole priviledge, and authority, that I, the said Matthias Koops, my executors, adm'ors, and assigns, and every of them, by himself and themselves, or by his and their deputy or deputies, servants, or agents, or such others as I, the said Matthias Koops, my executors, adm'ors, or assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term of years therein expressed, should and might lawfully make, use, exercise, and vend my said "invention for manufacturing paper from straw, hay, thistles, waste and refuse of hemp and flax, and different kinds of wood and bark, fit for printing and other useful purposes," within that part of the said United Kingdom of Great Britain and Ireland called England, the Dominion of

Wales, and town of Berwick-upon-Tweed, in such manner as to me, the said Matthias Koops, my executors, adm'ors, and assigns, or any of them, should in my or their discretion seem meet; in which said
600 letters-patent there is, amongst other things, contained a proviso, whereby it is declared that if I, the said Matthias Koops, should not particularly describe and ascertain the nature of my said invention, and the manner in which the same is to be performed, by an instrument in writing, under my hand and seal, and cause the same to be inrolled in the high court of chancery within twelve calender months next and immediately after the date of the said letters-patent, that then the said letters-patent, and all liberties and advantages whatsoever thereby granted, should utterly cease and become void, anything thereinbefore contained to the contrary thereof in any wise notwithstanding.

Now know ye that, in compliance with the said proviso, I, the said Matthias Koops, do hereby declare that my said invention is described in manner following, that is to say:

First. I dissolve to each pound of straw or hay intended to be made into paper about one pound and a half of quick-lime in about a gallon or one gallon and a half of river water. When the lime is sufficiently dissolved, I separate the stony and undissolved parts by decantation of the white opake fluid, or by drawing off the same by a cock or syphon, taking care to keep the mass so agitated that the fine dissolved particles may intermix and run off with the water.

Secondly. I take the straw or hay intended to be manufactured into paper, (when either of these materials is to be used,) and cut the same into portions about two inches in length, by means of a chaff-cutting engine, or by any other ready method; and I boil this last mass in a considerable quantity of water, namely, about two gallons of water, more or less, for every pound of the material, about three-quarters of an hour.

Thirdly. I draw *of* the liquor in which the straw or hay has been boiled, and then soak or macerate the material (in wooden vessels) in the mixture or combination of lime and water hereinbefore described, adding to the said mixture at the same time as much water as is sufficient to cover the whole mass, which I have generally found together in quantity to be about a gallon and a half to each pound of straw or hay, for six, seven, or eight days, (as circumstances may require, some lime being better than other lime, in which case the straw or hay may not be submitted to its operation so long,) but seldom les' than five days. I then take care that the lime shall be applied to the surface of the material as uniformly as possible by frequently stirring, turning over, or agitating the mass as often as may be requisite.

Fourthly. At the end of six, seven, or eight days, but seldom less than five, as aforesaid, I draw *of* the lime and water, and then wash the material, being straw or hay cut as aforesaid, very clean; after
601 which I boil the same for about one hour and a half or two hours in a large portion of clean river-water, calculating the quantity at about seven quarts of water to every pound of straw or hay in its original state; and to this boiling, after the straw or hay has boiled about one-quarter of an hour, and also to the lime and water at the commencement of the soaking or maceration, I, in some cases, add one pound of dissolved *chr*istal of soda or potash to every thirty-six pounds of straw or hay, for the purpose of improving the colour and texture of the paper; but these are not ingredients essentially necessary to be used in the process of making paper from straw or hay. I have only used either of them under an idea that they have in some cases improved the

colour, and may also have the effect of making some addition to the texture of the paper.

Fifthly. I again wash the material, and boil the same for about half an hour in a like quantity of water as aforesaid; after which I draw off and then press out the water, and proceed to manufacture the same into paper by the usual and well-known processes of making paper. In some cases I have found it advantageous to suffer the pressed material to ferment and heat for several days before I reduce it into pulp, in order to its being made or manufactured into paper. But in this the manufacturer must use his judgment according to the season, the quantities to be laid in mass, and other particulars, concerning which no general rule or specific instructions can be given, the change and alteration of season having so much influence on a process of this description.

Sixthly. As to that part of my said invention which respects the making of paper from thistles, I use the following process, (that is to say:) I first cause the thistles to be cut when the bloom begins to fall therefrom. I dry them, and cut the stems into lengths of two inches, and I then soak them in river water for twelve hours, and afterwards dissolve them, allowing one and a half pound of quick-lime to every pound of thistles when dryed, in about one and a half gallon of river water, which I separate from the stony part in the same manner as aforesaid, and then immerse the thistles in the lime and water, so separated, adding thereto at the same time so much water as is sufficient to cover the whole mass, which I have generally found to be in quantity altogether about a gallon or upwards to every pound of dried thistles. I soak or macerate them in this mixture for four or five days, taking care frequently to stir them, as described in the case of making paper from hay and straw. I then draw off the lime and water, and wash them as clean as possible; after which I boil them in river-water, allowing a gallon and a half of water to every pound of dried thistles, for one-quarter of an hour; then adding four pounds of potash or *chr*istal of soda dissolved in water to one hundred and eighty pounds of dried
602 thistles, and afterwards let them boil therewith for one hour and a quarter; this being done, I drain the liquor, and boil it again with a like proportion of river-water for half an hour; then the water is run off, and the thistles taken out of the copper and pressed, in which state it is manufactured into paper by the usual process.

Seventhly. With regard to the manufacture of paper from wood, according to my said invention, I reduce the wood into shavings, which being done, I cut the same with the chaff-cutting engine into lengths of about two inches; after which I boil them in the same manner as I have before set forth respecting the making of paper from straw and the other substances. I then take a quantity of quick-lime, in the proportion of one pound and a half, rather more than less, to one pound of the shavings in their dried state, and make the mixture for the process of soaking or macceration in the same manner as that before mentioned relative to making paper from the straw or hay. This soaking or macceration is continued for about six days, during which it must be frequently stirred, for the reasons before mentioned. The subsequent treatment of boiling, washing, and making it into paper, to be observed, is the same in this as has been described in the making paper from straw or hay. I think it here necessary to observe that I have only hitherto effectually made paper from willow and aspin wood, and I find that the wood which contains much turpentine or resinous matter cannot usefully and beneficially be made into paper. And with respect to the making paper from bark of different woods, the same method is followed as described in the

making paper from wood, except that the coarse outside of the bark is to be scraped or cut off, and not used.

Eighthly. With regard to the manufacture of paper from the refuse of hemp and flax, according to my said invention, I soak or macerate one hundred and eighty pounds of the raw material in lime-water, or the clear solution thereof, made by about two hundred and fifty pounds of lime being dissolved in two hundred and seventy gallons of river-water, to which I have usually added at the commencement of the soaking or maceration six pounds of potash or *chri*stal of soda dissolved in water, and continued the soaking or maceration for at least four days; I then boil it for one hour and a half, as before stated in the process for making paper of hay and straw; but I add in such boiling six pounds of potash or *chri*stal of soda dissolved in water, and let it remain for at least twelve hours in the liquor after the process of boiling ceases. I then draw off the liquor, and boil it again for half an hour in clear river-water; after this the liquor is again drained off, and the material or materials pressed. It is then made into paper in the usual method.

Ninthly and lastly. I do further declare and observe that, although I have hereinbefore described the operations wherein my said inven-
603 tion consists, and whereby the same may and can be more effectually performed and executed, yet, nevertheless, the whole is capable of and necessarily, like every other manufacturing process, subject to variations, which any person sufficiently skilled in the arts to conduct a work of this nature will without difficulty make and adapt, according to the circumstances of the case respectively, (that is to say:) The proportion of lime may be varied according to its goodness and to the intended speed of operation; and that this, as well as the time of soaking and maceration, and the number, order and duration of the boilings, may be varied according to the quality, growth, newness, age, gathering, storing, or other qualities or incident of or relating to the straw, hay, or other material; and that those woods are in general preferable which easily adhere to or combine with water, instead of such as are hard, oily, resinous, or in other respects obviously unfit for the purpose of making paper by any cheap or eligible previous preparation. I think it necessary further to remark that I have in all the before-mentioned cases used Thames water, because I could most easily procure that kind of water in the particular situation where the experiments have been made; but I do not mean by naming that water in the before-detailed mode of exercising or effecting my invention to infer that it is indispensably necessary that Thames or river-water should in all cases be used. Spring water may probably do as well, but that I am unable to state with certainty, for the reasons before given.

In witness whereof I, the said Mathias Koops, have hereunto set my hand and seal, this seventeenth day of February, in the year of our Lord one thousand eight hundred and two.

[L. S.] MATTHIAS KOOPS.

And be it remembered that, on the seventeenth day of February, in the year of our Lord 1802, the aforesaid Matthias Koops came before our said lord the King in his chancery, and acknowledged the specification aforesaid and all and everything therein contained and specified in form above written. And also the specification aforesaid was stampt according to the tenor of the statutes made for that purpose. SIMEON.

Inrolled the seventeenth day of February, in the year of our Lord one thousand eight hundred and two.

London: Printed by George Edward Eyre and William Spottiswoode, printers to the Queen's Most Excellent Majesty. 1856.

DEF'T'S EXHIBIT 5—K. G. W. *Ex'r.*

[COAT OF ARMS.]

A. D. 1838.] [No. 7643.

Specification of James Vincent Desgrand.—Paper and pasteboard pulp.—Filed May 21st, 1867.—Price 4d.

604 [Patent stamp, four-pence, canceled, and coat of arms.]

A. D. 1838.] [No. 7643.

Paper and pasteboard pulp.—Desgrand's specification.

To all to whom these presents shall come, I, James Vincent Desgrand, of Size Lane, in the City of London, merchant, send greeting:

Whereas Her present Most Excellent Majesty Queen Victoria, by her letters-patent, under the great seal of Great Britain, bearing date at Westminster the fifteenth day of May, in the first year of her reign, did, for herself, her heirs and successors, give and grant unto me, the said James Vincent Desgrand, her especial licence, full power, sole privilege and authority that I, the said James Vincent Desgrand, my ex'ors, adm'ors, and assigns, or such others as I, the said James Vincent Desgrand, my ex'ors, adm'ors, or assigns, should at any time agree with, and no others, from time to time and at all times during the term of years therein expressed, should and lawfully might make, use, exercise, and vend, within England, Wales, and the town of Berwick-upon-Tweed, the invention of "a certain new pulpy product or material, to be used in manufacturing paper and pasteboard, prepared from certain substances not hitherto used for such purposes," communicated to me by a certain foreigner residing abroad; in which said letters-patent is contained a proviso that I, the said James Vincent Desgrand, shall cause a particular description of the nature of the said invention, and in what manner the same is to be performed, to be inrolled in her said Majesty's high court of chancery within six calendar months next and immediately after the date of the said in part recited letters-patent, as in and by the same, reference being thereunto had, will more fully and at large appear:

605 Now know ye that, in compliance with the said proviso, I, the said James Vincent Desgrand, do hereby declare the nature of the said invention, and the manner in which the same is to be performed, are fully described and ascertained in and by the following statement thereof, that is to say:

The object of the patent consists in making paper and pasteboard with wood reduced into a state of paste. Therefore, my right of patent extends not only to the process of employing wood, but to the employment of the material itself. Among the different sorts of wood, I find that those which answer the best are those coming under the classification of white wood, such as poplars. I confine my patent to pure wood, exclusive of every possible bark or epidermis.

PROCESS.

When the trees are entirely deprived of their bark or epidermis, they are cut in logs of about four to six feet long. These logs are split in pieces of about two to six inches each way. These pieces of wood, of

about four to six feet long, and about two to six inches thick, are carefully assorted in their various shades or color, as you can make at less expence white paper out of the whitest pieces as well as you can make colored paper without any addition of coloring matter, if these shades were wanted, out of the shaded pieces; and by the addition of coloring matter you can produce all sorts of shade requisite with the white and with the colored pieces of wood. The above pieces of wood, of four to six feet long, and two to six inches thick, are chopped in small chips of about two to four inches long, and one to three inches in thickness, taking care to chop them so as to make as many openings or splinters in the chip as possible. The more open they are the more freely they admit the liquor, of which hereafter mention will be made, which liquor divide' and separate' the different fibres forming the texture of the wood. In doing the operation of chopping, it is necessary to reject all 'nots of the wood, all decayed parts, and all parts the fibres of which are not strai't. When you have a sufficient quantity of chips of one shade, they are deposited in a pit, water tight, in which there is an outlet for water, these pits being of a sufficient capacity to contain about half a ton of chips. Then you pour over them, so that they should be entirely covered, what in France is known under the name of "lait de chaux," which is, in fact, water saturated with lime as much as it will admit. The chips remain in that bath more or less, according to the temperature, in the south of France, from three to six weeks where necessary, to complete the action of the lime-water, which action has for its object to dissolve the glutinous parts of the wood, which keep the different fibres of the wood united together. You may be sure of
606 the efficacy of the bath when all the chips have sunk to the bottom of the pit, and not any left floating. When the chips are sufficiently dissolved, the saturated water is let out, and replaced by a sufficient quantity of natural water, so as to wash away all the lime-water, or as much as possible. In that state you may easily separate by the hand the fibres of the chips, but for employment they are submitted to the action of the stampers or fulling mallet to pound them. This pounding has for its object to open, divide, and flatten the fibres of the chips, and facilitate their further process they have to undergo in the usual paper-engine or cylinders, to reduce them in pulp. When the pulp is sufficiently reduced by the paper engine it is in a fit state to make paper or pasteboard, either by itself, or mixed with the usual material general' employed for manufacturing paper or pasteboard; and you may employ it or by a paper machine or by frames. In using the paper-engine, as now in operation for preparing rags or other usual materials, care must be taken to employ the same sort of tackle, but use it very blunt or dull. If for white paper, the fibres, after they have been pounded and flattened and divided, are submitted to the action of the several chemical products which have the property of bleaching vegetable produce.

In witness whereof, I, the said James Vincent Desgrand, have hereunto set my hand and seal this thirteenth day of November, one thousand eight hundred and thirty-eight.

[L. S.] JAMES VINCENT DESGRAND.

And be it remembered that, on the thirteenth day of November, in the year of our Lord 1838, the aforesaid James Vincent Desgrand came before our said lady the Queen in her chancery, and acknowledged the specification aforesaid, and all and everything therein contained and specified, in form above written. And also the specification aforesaid was stamped according to the tenor of the statute made for that purpose.

FARRER.

Inrolled the fifteenth day of November, in the year of our Lord one thousand eight hundred and thirty-eight.

London: Printed by George Edward Eyre and William Spottiswoode, printers to the Queen's Most Excellent Majesty. 1856.

DEF'TS' EXHIBIT 6.—K. G. W., *Ex'r.*

[COAT OF ARMS.]

A. D. 1838.] [No. 7772

Specification of George Robert D'Harcourt.—Manufacture of paper.—Filed May 21st, 1867.

607 [Patent-stamp, four pence, canceled, and coat of arms]

A. D. 1838.] [No. 7772.

Manufacture of paper.—D'Harcourt's specification.

To all to whom these presents shall come, I, George Robert D'Harcourt, of King William street, in the city of London, civil engineer, send greeting:

Whereas Her present most excellent Majesty Victoria, by her letters-patent under the great seal of Great Britain, bearing date the fifteenth day of August, in the second year of her reign, did for herself, her heirs and successors, give and grant unto me, the said George Robert D'Harcourt, her special license, full power, and privilege, and authority, that I, the said George Robert D'Harcourt, my ex'ors, adm'ors, and assigns, or such others as I, the said George Robert D'Harcourt, my ex'ors, adm'rs, or assigns, shall at any time agree with, and no others, from time to time and at all times during the term of years therein expressed, should and lawfully might make, use, exercise, and vend, within England and Wales, and the town of Berwick-upon-Tweed, and also in Her said Majesty's colonies and plantations abroad, my invention of "improvements in the manufacture of paper;" in which said letters-patent is contained a proviso that I, the said George Robert D'Harcourt, shall cause a particular description of the nature of my invention, and the manner in which the same is to be performed, to be enrolled in Her Majesty' high court of chancery within six calendar months next, and immediately after the date of the said in part recited letters-patent, as in and by the same, reference thereunto being had, will more fully and at large appear.

Now know ye, that in compliance with the said proviso, I, the said George Robert D'Harcourt, declare that the nature of my said in-
608 vented improvements, and the manner in which the same are to be performed, are fully set forth, and explained in the following description thereof, that is to say:

I take the leaves and stalks of the aloe, the sheaths or covering-leaves of the fruit or ear of the maize, otherwise Indian-corn, the leaves and stalks of the rice-plant, also the bines or stems of the hop-plant, the common field-bean, the scarlet and French bean, the stalks or stems of the asparagus, and potatoe-plant, and all stalks, leaves, and bines of similar vegetable substances. I take them when in a state of maturity, except in the case of the aloe, which is always fit for use. I place them in classes in open tanks or other suitable vessels, and expose them, for

some days, to the action of cold soft water, until, by maceration, the glutenous matter between the fibres becomes thoroughly soft and ready to be decomposed and separated. During cold weather, in lieu of the above, I effect the same object by fermentation accelerated by the application of heat of, at least, one hundred and twenty degrees of Fahrenheit. The next step I take is to effect a separation of the glutenous matter from the fibres by pressure in suitable presses. This being done, I take the fibrous matter, place it in covered metal-cauldrons, and expose it to the action of steam generated in a proper boiler. I put into the boiler a mixture of lime and oil, not being fish-oil, and no more oil than will bind the lime into a strong paste, the proportion of such paste to the fibres being as five to one hundred in weight. I then admit the steam into the cauldrons, having a common agitator to work within either perpendicularly or horizontally. By this operation, to continue in action for an hour or more as may be requisite, the cleansing of the fibres from all remaining impurities, and the bleaching thereof, is effected at the same time. I then remove the matter so cleansed and bleached, and wash it well by beaters in cold soft water; after which I extract the moisture, and form it into suitable masses for use. It is then to be submitted to the process of trituration as rags are, and converted into paper by the same means. By the above process, and by and out of each of the vegetable-substances above mentioned or referred to, and by and out of their combinations according to the quality or strength for which the paper is wanted, with or without the admixture of rags, I make paper of all qualities and kinds for all the various purposes for which paper is made and used; and I claim the particular process, herein described, of preparing, purifying, and bleaching the several vegetable substances above enumerated or referred to, the greater part of which have never hitherto been employed in the manufacture of paper, and the combination of the said several vegetable substances for the purposes of making an improved paper of dif-
609 ferent qualities. And such my said invented improvements being, to the best of my knowledge and belief, never heretofore used in this country, I declare this to be my specification of the same, and that I do verily believe this my said specification doth comply in all respects, fully and without reserve or disguise, with the proviso in the said hereinbefore in part recited letters-patent contained; wherefore I hereby claim to maintain exclusive right and privilege to my said invention.

In witness whereof I, the said George Robert D'Harcourt, have hereunto set my hand and seal, this fifteenth day of February, in the year of our Lord one thousand eight hundred and thirty-nine.

[L. S.] GEORGE ROBERT D'HARCOURT.

Signed, sealed, and delivered, by the within-named George Robert D'Harcourt, in the presence of—

J. W. CLAYTON,
Clerk to Messrs. Price & Bolton,
Of 1 New Square, Lincoln's Inn, sol'rs.

And be it remembered that, on the fifteenth day of February, in the year of our Lord 1839, the aforesaid George Robert D'Harcourt came before our said lady the Queen in her chancery, and acknowledged the specification aforesaid, and all and everything therein contained and specified, in form above written. And also the specification aforesaid was stamped according to the tenor of the statute made for that purpose.

LYNCH.

Inrolled the fifteenth day of February, in the year of our Lord one thousand eight hundred and thirty-nine.

London: Printed by George Edward Eyre and William Spottiswoode, printers to the Queen's Most Excellent Majesty. 1856.

DEF'T'S EXHIBIT 7.—K. G. W., *Ex'r.*

[COAT OF ARMS.]

A D. 1838.] [No. 7794.

Specification of Morton Balmanno.—Manufacture of paper, pasteboard, felt, and tissues.—Filed May 21st, 1867.

610 [Patent stamp, four pence, canceled, and coat of arms.]

A. D. 1838.] [No. 7794.

Manufacture of paper, pasteboard, felt, and tissues.—Balmanno's specification.

To all to whom these presents shall come, I, Morton Balmanno, of Queen street, Cheapside, in the city of London, merchant, send greeting:

Whereas Her Most Excellent Majesty Queen Victoria, by her letters-patent under the great seal of that part of the United Kingdom called England, bearing date at Westminster, the sixth day of September, in the second year of her reign, did, for herself, her heirs and successors, give and grant unto me, the said Morton Balmanno, her especial license, that I, the said Morton Balmanno, my ex'ors, adm'ors, and assigns, or such others as I, the said Morton Balmanno, my ex'ors, adm'ors, and assigns should at any time agree with, and no others, from time to time and at all times during the term of years therein expressed, should and lawfully might make, use, exercise, and vend, within England, Wales, and the town of Berwick-upon-Tweed, my invention of "A new and improved method of making and manufacturing paper, pasteboard, felt, and tissues;" in which said letters-patent there is contained a proviso obliging me, the said Morton Balmanno, by an instrument in writing under my hand and seal, particularly to describe and ascertain the nature of my said invention, and in what manner the same is to be performed, and to cause the same to be enrolled in Her Majesty's high court of chancery within six calendar months next and immediately after the date of the said recited letters-patent, as in and by the same, reference being thereunto had, will more fully and at large appear.

Now know ye that, in compliance with the said proviso, I, the said Morton Balmanno, do hereby declare that the nature of my said invention and the manner in which the same is to be performed are described and ascertained as follows, that is to say:

611 My new and improved method of making and manufacturing paper, pasteboard, felt, and tissues, consists in the employment of and working upon several substances, hereinafter described, which have not hitherto, by any processes, been converted into papers, or articles fit for the same purposes as paper, &c., &c., in a manner so proper as to make them good articles of commerce.

For the greater convenience of describing the nature of my discovery,

and explaining my modes of operation, I divide these several substances into five classes.

1st class: Bark of trees and the bark of young shoots of trees.

2nd class: Those herbaceous plants which partake of the nature of hemp or flax, having a skin or outward coating, such as hopbine, &c.

3rd class: Those plants not having an outward skin or coating, or having it in a very slight degree, but having a fibre intermixed with the ligneous part, such as the stalks of potatoes, &c.

4th class: Small roots of trees, shrubs, and plants.

5th class: Dead or dried leaves, exclusive of the leaves of maize or Indian corn.

FIRST CLASS.

When I use the first class of the aforesaid substances, viz, bark, I prefer the young shoots of trees of one, two, or three years' growth, such as osiers, and I proceed as follows: I put the osiers or other young shoots of trees either into hot or cold water to soak for three or four hours. The skin or outward coating may then be easily detached by the hand or by a machine. Having proceeded thus far, if I want to make any one of these substances into white paper, I wash it, then submit it to the action of steam, or I boil it in an open or closed boiler, either in water or water mixed in potash, soda, or other alkali, made caustic or otherwise; but the effect is more readily produced if made caustic, using from three to six pounds of alkali to one hundred weight of bark. The quantity of water or solution to be used should be sufficient to cover the material by three or four inches at least. Having thus steamed or boiled it for three or four hours, I strain off the liquor, and carefully wash the substance so steamed or boiled, and, if necessary, I again submit it to the same operation of steaming or boiling, with a further portion of alkali, for five or six hours longer. This operation should be repeated until the water is no longer discoloured, or only in a slight degree. The substance so boiled should be well washed after each boiling. After these operations have been gone through the substance is in a fit state to be put into the paper engine, and is easily reduced to what is known by paper-makers as half-stuff. I then
612 bleach this substance (so reduced to half-stuff) by the usual process of bleaching, and if it should be sufficiently white, I again boil it, as before described, and having again washed it, I bleach it a second time. I then make it into paper, or an article which may be used for the same purposes as paper, and which, therefore, I call in my patent and specification, paper, by the usual mode of trituration, and in the manufacture of paper. Pasteboard is, in the usual way, made with this paper. In operating upon shoots of above three years, and up to ten or fifteen years' growth, I do not begin by putting them to soak in water, but strip the bark off, as is usually done in stripping hop-poles. I then submit the bark so obtained to the process already described, of boiling and bleaching, always washing it after it has undergone each operation, taking out any portions of wood that may have adhered to the bark and which may not have been dissolved. I produce the same results from bark, taking from trees of any age, as the mulberry, &c.; but in operating upon them I first break off or separate the epidermis or outward coating, and only operate upon the fibrous part which exists between the outward coating and the body of the tree or branches. I then proceed, as before described, by boiling, bleaching, &c.

SECOND CLASS.

In operating upon that species of plant named in the second class as having a skin or outward coating, such as hopbine, &c., I either obtain the fibrous part by the known operation employed in obtaining the fibre of hemp or flax, or I proceed as when I operate upon osiers, that is to say, I first soak them for a few hours, and then strip off the outward skin, rejecting the ligneous part, sometimes called bullen. This substance, so detached from the ligneous parts, I carefully wash and then I boil and bleach it as before described. I prefer the fibrous substance obtained from this description for making tissues used in potteries, and other thin papers.

THIRD CLASS.

This class consists of such herbaceous plants as do not possess an outward skin, or only in a very slight degree, but having a fibre intermixed with the interior or ligneous part, such as the stalk of potatoe. With this description of plants I do not strip off the outward skin, if any. I commence by boiling, as before described, and which is known to be compleat' when the ligneous and mucilaginous part is sufficiently dissolved or softened, so to be easily detached and carried away by washing, leaving the fibrous part only. I then carefully wash this substance, and submit it to the same usual known operation of bleaching, and which I repeat as above described, if necessary.

613 FOURTH CLASS.

Consists of roots containing fibrous substances, such as licorice, &c. I begin by well washing or cleansing them from all dirt or earthy particles with water, and proceed precisely as described in regard to these substances, which I have before specified in the third class, dissolving and rejecting the ligneous parts in this process also.

FIFTH CLASS

Consists of dead or dried leaves, which I use indiscriminately. I collect the leaves without separating the different sorts, and then I subject them to the operation of boiling, washing, bleaching, and the other subsequent processes, as above described.

Although I have declared that, in the employment of working upon the several substances, I make use of certain processes by which I obtain the fibre, and which I afterwards bleach and manufacture into paper, pasteboard, and tissues, yet, when my object is to make felt or brown paper, I only use the processes described for the several classes for obtaining the fibre, such as strip'ing, soaking, and boiling and washing, and I omit altogether the operation of bleaching. The substances are by such means sufficiently prepared and fit to be made into felt or brown or wrapping papers. I disclaim all methods heretofore used with respect to any of the substances above classed, for fibrous materials may be obtained by other imperfect means. But I claim as my invention the discovery of the method by which the substances above classed are, by the processes above described, made fit for the purpose of being converted into paper or good articles of commerce, as paper, pasteboard, felt, and tissues.

In witness whereof I, the said Morton Balmanno, have hereunto set

my hand and seal, the fourth day of March, in the year of our Lord one thousand eight hundred and thirty-nine.

[L. S.] MORTON BALMANNO.

Signed, sealed, and delivered by the within-named Morton Balmanno, in the presence of—

JOHN S. GREGORY,
Bedford Row.
W'M PAUL METCHIM,
Clerk to Messrs. Adlington & Co., Bedford Row.

614 And be it remembered that on the fourth day March, in the year of our Lord 1839, the aforesaid Morton Balmanno came before our said lady the Queen in her chancery, and acknowledged the specification aforesaid, and all and everything therein contained and specified in form above written. And also the specification aforesaid was stamped according to the tenor of the statute made for that purpose. SENIOR.

Inrolled the fourth day of March, in the year of our Lord one thousand eight hundred and thirty-nine.

London: Printed by George Edward Eyre and William Spottiswoode, printers to the Queen's Most Excellent Majesty. 1856.

DEFT'S EXHIBIT 8.—K. G. W., *Ex'r.*

[COAT OF ARMS.]

A. D. 1838.] [No. 7850

Specification of Edward Cooper.—Manufacture of paper.—Filed May 21st, 1867.—Price 6d.

615 [Patent stamps, four pence and two pence, canceled, and coat of arms.]

A. D. 1838.] [No. 7850.

Manufacture of paper.—Cooper's specification.

To all to whom these presents shall come, I, Edward Cooper, of Piccadilly, in the county of Middlesex, stationer, send greeting:

Whereas Her present Most Excellent Majesty Queen Victoria, by her letters-patent under the great seal of Great Britain, bearing date at Westminster, the third day of November, in the second year of her reign, did, for herself, her heirs and successors, give and grant unto me, the said Edward Cooper, her especial license, full power, sole privilege and authority, that I, the said Edward Cooper, my ex'ors, adm'ors, and assigns, or such others as I, the said Edward Cooper, my ex'ors, adm'ors, or assigns, should at any time agree with, and no others, from time to time and at all times during the term of years therein expressed, should and lawfully might make, use, exercise, and vend, within England, Wales, and the town of Berwick-upon-Tweed, the invention of "Improvements in the manufacture of paper," communicated to me by a certain foreigner residing abroad; in which said letters-patent is contained a proviso that I, the said Edward Cooper, shall cause a particular description of the said invention, and in what manner the same to be

SECOND CLASS.

In operating upon that species of plant named in the second class as having a skin or outward coating, such as hopbine, &c., I either obtain the fibrous part by the known operation employed in obtaining the fibre of hemp or flax, or I proceed as when I operate upon osiers, that is to say, I first soak them for a few hours, and then strip off the outward skin, rejecting the ligneous part, sometimes called bullen. This substance, so detached from the ligneous parts, I carefully wash and then I boil and bleach it as before described. I prefer the fibrous substance obtained from this description for making tissues used in potteries, and other thin papers.

THIRD CLASS.

This class consists of such herbaceous plants as do not possess an outward skin, or only in a very slight degree, but having a fibre intermixed with the interior or ligneous part, such as the stalk of potatoe. With this description of plants I do not strip off the outward skin, if any. I commence by boiling, as before described, and which is known to be compleat' when the ligneous and mucilaginous part is sufficiently dissolved or softened, so to be easily detached and carried away by washing, leaving the fibrous part only. I then carefully wash this substance, and submit it to the same usual known operation of bleaching, and which I repeat as above described, if necessary.

613 FOURTH CLASS.

Consists of roots containing fibrous substances, such as licorice, &c. I begin by well washing or cleansing them from all dirt or earthy particles with water, and proceed precisely as described in regard to these substances, which I have before specified in the third class, dissolving and rejecting the ligneous parts in this process also.

FIFTH CLASS

Consists of dead or dried leaves, which I use indiscriminately. I collect the leaves without separating the different sorts, and then I subject them to the operation of boiling, washing, bleaching, and the other subsequent processes, as above described.

Although I have declared that, in the employment of working upon the several substances, I make use of certain processes by which I obtain the fibre, and which I afterwards bleach and manufacture into paper, pasteboard, and tissues, yet, when my object is to make felt or brown paper, I only use the processes described for the several classes for obtaining the fibre, such as strip'ing, soaking, and boiling and washing, and I omit altogether the operation of bleaching. The substances are by such means sufficiently prepared and fit to be made into felt or brown or wrapping papers. I disclaim all methods heretofore used with respect to any of the substances above classed, for fibrous materials may be obtained by other imperfect means. But I claim as my invention the discovery of the method by which the substances above classed are, by the processes above described, made fit for the purpose of being converted into paper or good articles of commerce, as paper, pasteboard, felt, and tissues.

In witness whereof I, the said Morton Balmanno, have hereunto set

my hand and seal, the fourth day of March, in the year of our Lord one thousand eight hundred and thirty-nine.

[L. S.] MORTON BALMANNO.

Signed, sealed, and delivered by the within-named Morton Balmanno, in the presence of—

JOHN S. GREGORY,
Bedford Row.
W'M PAUL METCHIM,
Clerk to Messrs. Adlington & Co., Bedford Row.

614 And be it remembered that on the fourth day March, in the year of our Lord 1839, the aforesaid Morton Balmanno came before our said lady the Queen in her chancery, and acknowledged the specification aforesaid, and all and everything therein contained and specified in form above written. And also the specification aforesaid was stamped according to the tenor of the statute made for that purpose. SENIOR.

Inrolled the fourth day of March, in the year of our Lord one thousand eight hundred and thirty-nine.

London: Printed by George Edward Eyre and William Spottiswoode, printers to the Queen's Most Excellent Majesty. 1856.

DEFT'S EXHIBIT 8.—K. G. W., *Ex'r.*

[COAT OF ARMS.]

A. D. 1838.] [No. 7850

Specification of Edward Cooper.—Manufacture of paper.—Filed May 21st, 1867.—Price 6d.

615 [Patent stamps, four pence and two pence, canceled, and coat of arms.]

A. D. 1838.] [No. 7850.

Manufacture of paper.—Cooper's specification.

To all to whom these presents shall come, I, Edward Cooper, of Piccadilly, in the county of Middlesex, stationer, send greeting:

Whereas Her present Most Excellent Majesty Queen Victoria, by her letters-patent under the great seal of Great Britain, bearing date at Westminster, the third day of November, in the second year of her reign, did, for herself, her heirs and successors, give and grant unto me, the said Edward Cooper, her especial license, full power, sole privilege and authority, that I, the said Edward Cooper, my ex'ors, adm'ors, and assigns, or such others as I, the said Edward Cooper, my ex'ors, adm'ors, or assigns, should at any time agree with, and no others, from time to time and at all times during the term of years therein expressed, should and lawfully might make, use, exercise, and vend, within England, Wales, and the town of Berwick-upon-Tweed, the invention of "Improvements in the manufacture of paper," communicated to me by a certain foreigner residing abroad; in which said letters-patent is contained a proviso that I, the said Edward Cooper, shall cause a particular description of the said invention, and in what manner the same to be

performed, to be inrolled in her said Majesty's high court of chancery within six calendar months next and immediately after the date of the said in part recited letters-patent, as in and by the same, reference being thereunto had, will more fully and at large appear.

Now know ye, that in compliance with the said proviso, I, the said Edward Cooper, do hereby declare the nature of the said invention, and the manner in which the same is to be performed, are fully described and ascertained in and by the following statement thereof, reference being had to the drawing hereunto annexed, and to the figures and letters marked thereon, that is to say:

616 The invention relates, first, to the application of pulp made from the sugar-cane, in the manufacture of paper; and secondly, to improvements in the paper-engine; and in order to give the best information in my power, I will proceed to describe the process pursued by me in obtaining pulp from sugar-cane, though such process may be varied, the first part of the invention not relating to any particular process of making pulp but to the application of pulp produced from sugar-cane to the purpose of making paper, whether paper be made wholly of such pulp, or such pulp combined with the pulp produced from other material. Hitherto the sugar-cane deprived of its syrup, and called cane-trash or mogoss, has been employed as fuel or manure, either of which applications renders but little pecuniary benefit, compared with what it might produce by being converted into paper, of which it is ascertained to be susceptible at moderate expence and little trouble. The cane-trash is to be thoroughly bruised, and cut or reduced into small fragments about two inches in length, and immersed in rain or river water, and soaked until it sinks; and after being drained is to be transmitted to the washing-engine, where, having undergone the necessary washing and trituration fitting it for the beating-engine, it should be bleached, and subsequently treated according to the routine followed by paper-makers, and the pulp produced therefrom is to be made into paper either in combination with other pulp, according to the object desired to be obtained, and as is well understood by paper-makers.

I will now describe the second part of the invention. According to the present mode of constructing paper-engines, the roller or cylinder is of the enormous mass of fifteen to twenty hundred weight, in order to reduce to a pulp the matter of rags or other material, the operation of which is accompanied by a great noise and shocks; (added to which) this roller, from its position whilst in action, is never parallel with the plate until let down with its whole power thereupon, causing a ruinous and unnecessary wear and tear. The greater part of the time the roller forms an angle, more or less acute, with the plate, whilst the pinion is thrown to a certain degree out of gear, in consequence of the roller end of the spindle being thrown up, and thus endangering the cogs of both pinion and main wheel. In order to remedy these evils, I fix the roller B, Figure 1, perfectly horizontal in the engine A A, from which position it cannot deviate, but be always parallel with the plate C, which I render movable in its box by suspending it at each end by the four corners, bearing each a bar or bolt of metal E, to the four levers F, F, above the roller B, resting each upon its fulcrum G, acting independently of each other like steelyards, by means of weights H H, on their arms,

617 and which, being moved backwards or forwards, regulate the pressure of the plate against the roller to any degree required, thus accomplishing that which has been hitherto considered as impossible; and it is this graduating of the pressure which constitutes the chief merit of this invention. The handle or crank L serves to turn

the pulley K, and to move all the weights simultaneously upon the four levers in either direction, they being attached to it by chains or cords M M, at both ends, and passing round the pulleys K K, upon the ends of the lever-arms. The plate-box should be open at the near end, and need only be shut when the engine is at work, by a flanch of iron to close in the plate without bearing against it so as to impede its up and down movement. It is supported in the box at each end by a band or sling of iron O O, passing under and sunk at each side into the frame of the box, the upper ends being flush with the upper surface of the box, and into these upper ends are screwed the bars or bolts above-mentioned, which hold the plate suspended to the levers. This arrangement has been adopted in order that the plate may be withdrawn occasionally for examination without the necessity of disturbing the box or unscrewing the bolts which need seldom be moved.

References to the parts of the drawing: A A, engine; B, roller; C, plate; E E, two of the four bars or bolts screwed into the sling which suspends the plate from the levers F F; F F, two of the levers which raise and lower the plate; G G, two of the fulcrums; H H, two of the movable weights; I I, two of the grooves in which the arms of the levers slide, to keep them steady and prevent vacillation; K K, two of the pulleys or reels; L, cranks which turn the reels or pulleys that move the weights to and fro; M M, chains or ropes attached to each end of the weights, and passing round the reels or pullies; N N, box which contains the plate; O O, sling which supports the plate and suspends it to the levers.

Having thus described the nature of the invention, I would remark that I lay no claim to any of the processes through which it is necessary to pass the material to form pulp, nor to any process of making pulp into paper, they being well understood; nor do I claim any part of the paper-engine, which is well known. But what I claim is:

First. The application of pulp made of sugar-cane in the process of making paper; and

Secondly. I claim the mode of constructing a paper-engine, as herein described.

In witness whereof I, the said Edward Cooper, have hereunto set my hand and seal this third day of May, in the year of our Lord one thousand eight hundred and thirty-nine.

[L. S.] EDW'D COOPER.

(Here follows diagram, marked page 617.)

618

And be it remembered that on the third day of May, in the year of our Lord 1839, the aforesaid Edward Cooper came before our said lady, the Queen, in her chancery, and acknowledged the specification aforesaid, and all and everything therein contained and specified, in form above written. And also the specification aforesaid was stamped according to the tenor of the statute made for that purpose.

Inrolled the third day of May, in the year of our Lord one thousand eight hundred and thirty-nine.

DOWDESWELL.

London: Printed by George Edward Eyre and William Spottiswoode, printers to the Queen's Most Excellent Majesty. 1856.

619 DEFT'S EXHIBIT 9.—K. G. W. *Ex'r.*

[COAT OF ARMS.]

A. D. 1838.] [No. 7883.

Specification of John Small.—Manufacture of thread, or yarn, and paper.—Filed May 21st, 1867.

620 [Patent stamp, four pence, canceled, and coat of arms.]

A. D. 1838.] [No. 7883.

Manufacture of thread or yarn, and paper.—Small's specification.

To all to whom these presents shall come, I, John Small, of the Old Jewry, in the city of London, merchant, send greeting.

Whereas Her present most excellent Majesty Queen Victoria, by her letters-patent under the great seal of Great Britain, bearing date at Westminster, the first day of December, in the second year of her reign, did, for herself, her heirs, and successors, give and grant unto me the said John Small, her especial license, full power, sole privilege and authority, that I, the said John Small, my ex'ors, adm'ors, and assigns, or such others as I, the said John Small, my ex'ors, adm'ors, or assigns, should at any time agree with, and no others, from time to time and at all times during the term of years therein expressed, should and lawfully might make, use, exercise, and vend, within England, Wales, and the town of Berwick-upon-Tweed, the invention of "Improvements in the manufacture of thread or yarn and paper, by the application of certain fibrous materials not hitherto so employed," communicated to me by a certain foreigner residing abroad; in which said letters-patent is contained a proviso that I, the said John Small, shall cause a particular description of the nature of the said invention, and in what manner the same is to be performed, to be enrolled in her said Majesty's high court of chancery within six calendar months next and immediately after the date of the said in part recited letters-patent, as in and by the same, reference being thereunto had, will more fully and at large appear.

621 Now know ye, that in compliance with the said proviso, I the said John Small, do hereby declare the nature of the said invention, and the manner in which the same is to be performed, are fully described and ascertained in and by the following statement thereof, that is to say:

The invention relates to the application of the vegetable fibre of the following substances: the banana, the plantain, the aloe, the fig, and palm trees, for the manufacture of paper and cordages; and in order to give the best information in my power, I will proceed to describe the process to which such substances are to be submitted, in order to obtain the fibrous products; but I would first remark, that many matters have been of late years attempted to be used in the making of paper in substitution of rags, owing to the great demand for paper; and it is well known that the supply of rags is comparatively small when considered in respect to the demand; hence it is desirable to obtain materials which may be suitable for the purpose, and at a cost at which the same may be beneficially employed; and, further, it is desirable, if possible, that such materials should be of the growth of this country, or of some of her colonies. And it will be found that the substances above-mentioned may

be had in large quantities, and admirably applicable to the making of thread and yarn, and to be used in the making of paper. The substances above-mentioned are first to be submitted to the process of being well crushed, then soaked and well washed, by which means the fibre will be readily separated. The crushing process is performed by rollers; such as are used for crushing the sugar-can' are those which have been employed. The fibre from these substances is then to be treated by the ordinary process, when for making thread or yarn, to which hemp and flax are submitted. By this means most valuable thread and yarn may be obtained, to be woven into fabrics, making paper, and for other purposes to which thread and yarn are usually employed, and when used for making paper the fibrous materials are to be formed into pulp, and made into paper in like manner to what is usually resorted to in making paper from other fibrous materials; and in the making of paper the same may be wholly of such substances as above-mentioned, or the pulp thereof may be mixed with any other suitable pulp.

Having thus described the invention, I would remark that I do not confine myself to any particular mode of obtaining the fibres from the above-mentioned substances, nor to any subsequent process, in order to the making of thread, yarn, or paper therefrom. Nor do I claim any of such process, or the machinery so employed, when uncombined with the production of thread, yarn, or paper from such substances. But
622 what I claim is, the application of the vegetable fibres obtained from the banana, the aloe, the fig, the palm, and the plantain-trees in the making of thread, yarn, and paper.

In witness whereof, I, the said John Small, have hereunto set my hand and seal this twenty-eighth day of May, in the year of our Lord one thousand eight hundred and thirty-nine.

[L. S.] J. SMALL.

And be it remembered, that on the twenty-eighth day of May, in the year of our Lord 1839, the aforesaid John Small came before our said lady the Queen in her chancery, and acknowledged the specification aforesaid, and all and everything therein contained and specified, in form above-written. And also the specification aforesaid was stamped according to the tenor of the statute made for that purpose. WINGFIELD.

Inrolled the first day of June, in the year of our Lord one thousand eight hundred and thirty-nine.

London: Printed by George Edward Eyre and William Spottiswoode, printers to the Queen's Most Excellent Majesty. 1856.

623 DEF'TS' EXHIBIT 10.—K. G. W., *Ex'r.*

A. D. 1839.] [No. 8273.

Specification of Miles Berry.—Treating fibrous plants for the manufacture of paper, yarns, cloth, &c.—Filed May 21st, 1867.—Price 4d.

[Patent stamp, four pence, canceled, and coat of arms.]

A. D. 1839.] [No. 8273.

Treating fibrous plants for the manufacture of paper, yarns, cloth, &c.—Berry's specification.

To all to whom these presents shall come I, Miles Berry, of the office for patents, 66 Chancery lane, in the county of Middlesex, patent-agent, send greeting:

Whereas Her present most excellent Majesty Queen Victoria, by her royal letters-patent, under the great seal of Great Britain, bearing date at Westminster, the nineteenth day of November, in the third year of her reign, did, for herself, her heirs and successors, give and grant unto me, the said Miles Berry, her especial licence, full power, sole privilege and authority, that I, the said Miles Berry, my executors, administrators, and assigns, and such others as I, the said Miles Berry, my executors, administrators or assigns, should at any time agree with, and no others, from time to time, and at all times during the term of years therein mentioned, should and lawfully might make, use, exercise, and vend, within England, Wales, and the town of Berwick-upon-Tweed, and also in all Her Majesty's colonies and plantations abroad, "An invention or discovery by which certain textile or fibrous plants are rendered applicable to making paper, and spinning into yarns and weaving into cloth, in place of flax, hemp, cotton, and other fibrous materials commonly used for such purposes," being a communication from a foreigner residing abroad; in which said letters-patent is contained a proviso obliging me, the said Miles Berry, by an instrument in writing under my hand and seal, particularly to describe and ascertain the nature of the said invention, and in what manner the same is to be performed, and to cause the same to be inrolled in Her Majesty's high court of chancery, within six calendar months next and immediately after the date of the said in part
624 recited letters-patent, as in and by the same, reference being thereunto had, will more fully and at large appear:

Now know ye that, in compliance with the said proviso, I, the said Miles Berry, do hereby declare that the nature of the said invention, and the manner in which the same is to be performed, is particularly described and ascertained in and by the following description thereof, that is to say:

The invention or discovery, intended to be secured under the above in part recited letters-patent, is the application and use of a certain decription of textile or fibrous plant, generally called or known by the name "Esparto, and is of the class of plants named "Stipa," genus "Gramina," and is commonly called "Esparto," or "Stipa terracissima," and grows more particularly on the southern coast of Spain and the borders of the Mediterranean Sea and Straits of Gibralter, but is also found in Greece and the northern parts of Africa. This plant is of a fibrous or textile nature, and is capable of being applied to many useful purposes. It grows in abundance in many of the parts above named, and may be easily collected ready for exportation.

And I will now proceed to describe the mode of treating the said fibrous plant or material, in order to render the same applicable to the above-named useful purposes, as communicated to me by my correspondent residing abroad.

First. Its textle or fibrous nature enables it to be used in making paper, either colored or white, of different qualities, and card-boards of all descriptions, either in place of or in conjunction with rags, old ropes, &c., or other materials, commonly used in such manufacture.

Second, to be used in the manufacture of ropes or cordage.

Third. To be used in the manufacture of mats, carpets, cart-covers, and such other coarse articles of all descriptions.

Fourth. To be used in place or imitation of wool and hemp, and in the

manufacture of linen, and may be combed, carded, and spun after the manner of treating and preparing flax or hemp.

The following is the manner or process to be used or employed to render it for the above purposes:

First. To make white paper and card-boards it is necessary to beat or bruise the material or crush it, then to steep it in lime-water of about the strength of two pounds of lime for one hundred pounds of "Esparto," allowing it to steep until it begins to ferment. It is then to be put into the ordinary pulp engines used in paper-mills, and mixed with one quarter, one-third, or one-half of rags or other fibrous material, according to the strength and quality of paper wanted to be produced; the material being thus reduced, it may be bleached in the usual manner, and afterwards sifted or refined, and made into paper either by machinery or by hand. When applied or used to make common or ordinary papers or cardboards for the jacquard loom and other purposes, it can be used in its natural state after having been left in hot water for about twelve hours, and then acted upon by the pulp-engine, together with one-fourth, one-third, or one-half of rags, these materials being sufficiently reduced to make paper and card-board as usual. In order to make ropes or cordage, this material can be used in the natural state after being saturated with hot water, or after being beaten and combed, or treated like hemp, flax, or other fibrous materials. And in order to make mats, carpets, cart-covers, or other coarse articles, it can be used in the natural state; or, after being beaten and combed, and then dyed in different colours, and woven as usual, with or without other fibrous materials.

The process required to prepare this plant, so as to imitate wool, hemp, &c., and to employ it in place of the same, is as follows: First, to beat the plant or separate the fibres, then to comb it or card it when in a moist state, or when dry; afterwards the required degree of whiteness may be given to it by means of chloride of lime or other bleaching material.

In witness whereof I, the said Miles Berry, have hereunto set my hand and seal, this nineteenth day of May, in the year of our Lord one thousand eight hundred and forty.

[L. S.] MILES BERRY.

And be it remembered that, on the nineteenth day of May, in the third year of the reign of Her Majesty Queen Victoria, the said Miles Berry came before our said lady the Queen in her chancery, and acknowledged the instrument aforesaid, and all and everything therein contained and specified, in form above-written. And also the instrument aforesaid was stamped according to the tenor of the statute made in the fifty-fifth year of the reign of His late Majesty King George the Third.

WILSON.

Inrolled the nineteenth day of May, one thousand eight hundred and forty.

London: Printed by George Edward Eyre and William Spottswoode, printers to he Queen's Most Excellent Majesty, 1856.

626 DEF'TS' EXHIBIT 11.—K. G. W., *Ex'r.*

[COAT OF ARMS.]

A. D. 1843.] [No. 9787.

Specification of Lemuel Wellman Wright.—Machinery or apparatus for bleaching fibrous substances, and manufacturing the same into paper.—Filed May 21st, 1867.—Price 1s. 10d.

[Patent stamps, one shilling ten pence, cancelled, and coat of arms.]

A. D. 1843.] [No. 9787.

Machinery or apparatus for bleaching fibrous substances, and manufacturing the same into paper.—Wright's specification.

To all to whom these presents shall come I, Lemuel Wellman Wright, of Gresford Cottage, North Wales, engineer, send greeting:

Whereas Her present most excellent Majesty Queen Victoria, by her royal letters-patent under the great seal of Great Britain, bearing date at Westminster, the fifteenth day of June, one thousand eight hundred and forty-three, and in the sixth year of her reign, did, for herself, her heirs and successors, give and grant unto me, the said Lemuel Wellman Wright, her especial licence, full power, sole privilege and authority, that I, the said Lemuel Wellman Wright, my executors, administrators, and assigns, and such others as I, the said Lemuel Wellman Wright, my executors, administrators, or assigns, should at any time agree with, and no others, from time to time and at all times during the term of years therein expressed, should and lawfully might make, use, exercise, and vend, within England and Wales, and the town of Berwick-upon-Tweed, and in all the islands of Jersey, Guernsey, Alderney, Sark, and Man, and also within all Her Majesty's colonies and plantations abroad, my invention of "certain improvements in machinery or apparatus for bleaching various fibrous substances;" and also an invention of "improvements in machinery or apparatus for converting or manufacturing the same into paper," (partly communicated to me by a foreigner residing abroad;) in which said letters-patent is continued a proviso, that I, the said
627 Lemuel Wellman Wright, shall cause a full and particular description of the nature of the said invention, and in what manner the same is to be performed, to be enrolled in Her Majesty's high court of chancery, within six calendar months next and immediately after date of the said in part recited letters-patent, as in and by the same, reference being thereunto had, will more fully and at large appear:

Now know ye that, in compliance with the said proviso, I, the said Lemuel Wellman Wright, do hereby declare that the nature of the said invention, and the manner in which the same is to be performed, is particularly described and ascertained in and by the drawings hereto annexed, and the following explanation thereof, that is to say:

These improvements in machinery or apparatus for bleaching various fibrous substances consists—

Firstly. In the novel arrangement and construction of the several parts of the machinery or apparatus employed, and in the application of the same to the process of bleaching straw and other fibrous substances, (such as wheat, oat, barley, or rye straw, and jute-wood, commonly called surat,) to be used for the manufacture of various kinds of paper, mill-board, card-board, button-board, &c.

Secondly. In the particular machinery or apparatus for washing and cleansing all the dirty or extraneous matter from the straw or other fibrous substances.

Thirdly. In the peculiar adaptation of the machinery or apparatus used or employed for reducing the same into a state of pulp.

Fourthly. In the continuation of the washing of the fibre in the pulpy state, and in the peculiar apparatus or machinery employed for the purpose of boiling the same by high-pressure steam.

And, fifthly. In the machinery or apparatus for washing from the boiling process for performing the souring chloride or other chemical processes, and thus perfecting the operation of bleaching the pulp ready for use, as hereinafter described.

The improvements in machinery or apparatus for converting the same into paper apply more particularly to that construction or arrangement of paper-making machinery for which letters-patent were granted to me by His late Majesty William the Fourth, bearing date at Westminster, the fifteenth day of November, one thousand eight hundred and thirty-four, the specification of which was duly enrolled in the rolls chapel office, and to which I shall hereinafter refer as may be required.

In order that the present improvements may be fully described
628 and shewn in detail, I have attached to these presents three sheets of drawings, the first of which represents the machinery or apparatus for bleaching and preparing the straw or other fibre, and drawn upon a scale of about one-quarter of inch to the foot; the second and third represent the improvements in the machinery or apparatus connected with the manufacture of paper from the said fibrous pulp.

DESCRIPTION OF THE DRAWINGS.

In sheet 1, Fig. 1 is a longitudinal elevation of the bleaching-apparatus, being drawn mostly in section to shew the working of the process more clearly, and Fig. 2 is a plan view of the same, as seen from above, in which I have shewn a set of the apparatus arranged. Similar letters of reference are marked upon corresponding parts of the apparatus in both the figures. The tub or vessel A is for the purpose of mixing lime and water together, commonly called solution of lime or "milk of lime." Steam is admitted into this tub by the pipe *a* for the purpose of boiling; water is admitted as required by the pipe *b*, and the top and pipe *c* are for the purpose of drawing off the lime-liquor into the tubs B B. These tubs or boiling vessels may be made of wood or metal, and are intended to contain the straw or other fibre in which it is to be boiled with the lime-liquor previously prepared. The said tubs to be covered down with lids, and made steam-tight with safety-valves, which boiling process should continue for about twelve hours. *d* is the steam-pipe for boiling the contents of the vessel; *e*, the pipes for admitting water, which may be previously heated in the two auxiliary vessels *f* and *g*. The pipe e^x is for the admission of cold water, if required; and *h h*, are the pipes and valves for drawing off the straw or fibre and liquor into the washing-tubs C C, when sufficiently boiled. The tub C is for the purpose of washing the lime and colouring matter from the straw or fibre, and is provided with a false bottom, covered with wire gauze or cloth of about No. 12 mesh, (in order that the fibre may be retained in the tub,) when the water is drawn off by the pipe *i*; and it is also furnished with an agitator, kept in continued motion by means of its driving-gear, drum, and strap *k k*, which will prevent the wire-cloth from being choked or filled up by the lime-powder, as well as keep the whole mass in action during

the washing process. Water is admitted as required by the pipe *l*, and drawn off by the pipe *i*. After being well washed and cleansed, the straw or fibre has to be removed from this vessel, and submitted to the grinding or pulping apparatus D D, conveniently attached. Each machine or apparatus is composed of two large cast-iron rollers *m m m m*, of about five feet diameter and about five tons weight, each roller
629 revolving on a stationary axle *n n n n*, properly secured in the frame-work and bearing or rolling by friction of contact upon the bottom circular iron plate, bed, or trough *o o o o*, which is caused to revolve by means of the bevilled teeth cast or fixed in segments upon the under sides, being driven by the pinion and shaft *p p*, and supplied with water as required by the pipe *q q*. The boiled straw or fibre from the tub C *in* now to be thrown into this trough or bed and under the rollers, to which it is conducted by guides s^x s^x s^x s^x, and is allowed to remain under the grinding action of the rollers about fifteen minutes, more or less, as the nature of the material may require, until the pulping process will be completed, when the pulp may be taken out from under the rollers and placed into the tub E, which is of the same construction, and used for a repetition of the same purpose as the tub C, with this exception only, that the wire-cloth constituting the false bottom of this tub must be of a finer texture, that is, about No. 30 mesh. The pipe and tap *r* from this tub is intended for drawing off the waste water with the coloring matter that passes from the pulp during the process of washing, the pipe S at the same time admitting pure water. After this second washing the pulp is to be passed through the pipes and cocks *t t*, into the close iron kiers F F, wherein it is to be boiled again in lime-water, commonly called "milk of lime," as before, for about six hours. These kiers have steam-tight covers, safety-valves, and man-holes. *u* is the pipe admitting steam for boiling; and V, a water-pipe for drawing water into the kiers. When the pulp has thus been boiled for six hours, the steam must be shut off from the pulp *u* and introduced above the liquor by the steam pipes *w w*, which will bring the pressure of the steam upon the top of the pulp, and when the tap *x* is opened in the bottom pipe *y*, the pulp and liquor will be forced up the pipe *z* and discharged into the tubs G G, where it is to be washed again, and in the same way as before described, excepting in this case the bottom of the tub is covered with fine pierced or perforated sheet-lead of about four pounds weight to the square foot. The pulp now being in the tub G G, must in this stage be well washed and agitated with water, constantly running in at the pipe 1, and drawn off as required at the pipe 2. When sufficiently agitated in this vessel, the pulp must be submitted to the action for about two hours (still kept in motion,) of a solution of sulphuric, muriatic, or other acids of the ordinary strength used for bleaching purposes, washed as before until the acid is all removed from the pulp, when it is to be returned through the pipe 3 into the close keirs F, when it must be boiled again in a solution of alkali of 2° No. 1 hydrometer, which should be continued for about four hours, or until the strength of the alkali is spent, when the pulp and alkaline liquor is forced back into the tub G again and washed, as before
630 described. The washing being completed, the pulp is to be agitated in a solution of chloride of lime or bleaching liquor (of the ordinary bleaching strength) for about two hours, and then the solution is to be brought to the boiling-point by the admission of steam into the tub; after the chloride or bleaching liquor is entirely spent, the pulp and liquor is to be let down through the pipe and valve 4 into the tub H, when washing must again be performed therein, and when the chloride or

bleaching liquor is all washed out it must be submitted to the process called souring, consisting of an immersion in a solution of acid and water, where, after being agitated for about four hours, the whole is to be let off through the pipes and valves 5 5, into the tubs I I below, where it may remain until the next batch is ready for "souring." The "souring" liquor is to be pumped up the pipe 6 into a tub above, to be ready for use again as required; the pipe 7 is for a supply of fresh water when wanted and the pipes 8 and 9 are for drawing off the "souring" liquor when spent and of no further use. After the working of the whole of this improved bleaching machinery or apparatus as above-described, the straw-pulp, or other fibrous material will be perfectly bleached, and fit for the subsequent manufacture of white paper. But I would remark in conclusion of this first part of my specification, that when the pulp is not intended to be used for white paper, the preparing process may be discontinued after the boiling of the pulp in the close kiers F F, prior to its being carried into the tubs G G; and also, that after the pulping and bleaching processes have been completed as above described, the pulp may be submitted to the ordinary rag-engine for an hour or so, for the purpose of washing, blueing, and clearing the stuff prior to its introduction to the paper-machine.

In sheet 2, Fig. 1 is a sectional elevation of an improved paper-making machine with sizing and cutting apparatus attached; and Fig. 2 is an elevation of the delivering end of the paper-machine. In sheet 3, Fig. 1 is a plan or top view of the paper-machine with sizing and cutting apparatus complete, and Fig. 2 is a longitudinal elevation of the same. The pulp being placed in the vat A, flows through a sluice along the trough B into the dressing, clearing, or sifting apparatus C, which is worked as usual. The pulp leaves this vessel by a trough, and is raised by means of an ordinary bucket-wheel or elevator in the box D, and forced along the trough E into the vat F, in which the moulding-cylinder G revolves. In this improved construction of paper-making machine, the moulding-cylinder G, for making the continuous length of paper, and the adaptation thereof, and the mode of regulating the quantity or thickness of the paper to be produced, together with other general arrangements of the machinery, are exactly similar to that described in the specification of my former patent of one thousand eight hundred and thirty-four, which it is necessary here to repeat in order that the application of the present improvements may be properly understood; that is, several wheels or drums are firstly made fast upon the axle or shaft of this cylinder G, which are placed at from three to four inches apart for the purpose of giving stability to the ribs which are to form the cylinder, the two outer or end rings being made with strong flanches. When these wheels have been fixed on the shaft, longitudinal wires or round bars of metal about one-quarter of an inch in diameter are attached to the outer parts of the rims of the wheels, parallel to each other, and in the direction of the axle, at about a quarter of an inch apart. The rods bear in notches in the peripheries of the wheels, their ends being passed through holes in the end flange-rings, and they are drawn tight by screw-nuts or rivetted at the outside of the flange-rings. These ribs having been secured to the flange-rings, and thereby made to form a cylindrical cage, a continuous wire, about the sixteenth of an inch in diameter, is then tightly wound around the periphery of the cylinder in the direction of a spiral or screw, in order to hold the longitudinal bars firmly in their places in the notches of the peripheries of the wheels. Over this spiral wire round the cylinder is to be a covering of woven wire or wire-cloth, having about eighteen meshes in the inch, which wire-

cloth is to be fastened in the usual way of securing wire-cloths upon paper-making cylinders, and over this wire-cloth a covering is to be put of fine vellum wire-cloth, adapted to the kind of paper intended to be made; one end of this cylinder is to be closed water-tight, the other end being open for the free passage of the water between the arms. A cylinder constructed as described is represented in the drawing in connection with a machine for making a continuous sheet of paper, with the drying, sizing, and cutting apparatus. The moulding-cylinder G is mounted in the vat F F, the end of its axle turning in bearings fixed on the edges of the vat. Paper-pulp prepared in the usual way is to be supplied to the vat and kept at one uniform height by an overflow trough during the operation of making paper by the ordinary means, the moulding-cylinder being immersed to the depth of about half or more of its diameter in the pulp. The open end of the cylinder is made to work water-tight against the side of the vat. The reason for packing one end of the cylinder and closing the other end is, that no water shall pass from the vat into the cylinder except through the wire-cloth round its periphery. Near the lower part an aperture is made through the vat to the discharging trough E^1 E^1, which aperture communicates with the interior of the cylinder G for the purpose of drawing the water therefrom.

632 This aperture has a sluice shutter-cock or valves, to limit the flow of the water from within, and thereby to regulate the hydraulic pressure on the outer or moulding surface of the cylinder, and thus determine the thickness of the paper by regulating the deposit of pulp thereon. The moulding-cylinder is intended to revolve in the direction of the arrow; it is moved by the friction of the travelling endless web of felt H H, passed round the couching-roller I, between the pressing-roller K and the drying-cylinder L. This drying-cylinder or the pressing-roller may be put in motion by wheel geer or straps applied to the end its axle. After the formation of paper by the deposit of pulp upon th cylinder G, the water is passed from the interior of the cylinder by mean of the trough E^1 to the pulp-dresser or strainer C and the elevator. Th paper is now taken up by the felt by the action of the crouch detaching the paper from the moulding-cylinder, and conduc the pressing-cylinder K and drying-cylinder L. The drying- dis- is an improvement upon my former plan, and consists in the u tion of a large metallic cylinder L (say, of cast-iron, and made hollow, for the purpose of being heated by steam or otherwise,) and the paper is passed nearly all round this cylinder between the pressing-rollers K^1 K^1, and steam-heated smoothing-rollers M M, (all being driven by friction of contact with the drying-cylinder, which imparts a peculiar and highly finished surface to the paper. The fibre is in consequence compressed or consolidated, adapting it for writing with ease and dispatch, and when used for printing purposes it yields a clear impression with less power. As the paper is dried and finished, it is conducted from the drying-cylinder by the small roller N, just in front of the doctor or clearer O, (which is for the purpose of preserving the surface of the drying-cylinder free from any small particles of fibre which may adhere thereto,) and passes on to the sizing-machine annexed. It will be observed that the endless felt H H, runs in a box of water P for the purpose of being washed (without stopping the machine,) which is also provided with a revolving beater Q, acting against the back of the felt as is travels through the water. A stretching apparatus R R, is also provided for the felt, whereby it is tightened or slackened by the elevation or depression of the roller R^1 in its groove, and acted upon by the chain S, fixed at each end of the roll, passing over a pulley above and communi-

ting with a catch or ratchel-wheel below. The paper now passes into the sizing-machine over the conducting-roller T. U is a brass roller, placed in a horizontal position in the side-frames, and pressed by means of set screws against a wooden roller V, each roller being furnished with a doctor or clearer. The size is raised by means of a pump from the cistern W, and discharged into the space or trough formed by the contact of the two rollers, and by means of gates or boards fitting tightly against the end of the rollers, the size is kept to the height of the top of the roll U, the cavity containing the body of size through which the paper (shewn by the blue line) passes being thus formed between the rolls and the end-gates or boards. The paper after the sizing process passes over the conducting-roller W^1 to the cutting-machine, constructed for the purpose of simply dividing the hitherto continuous length of paper into sheets by means of a revolving-cutter; it consists simply of a cutting-blade X being placed along the periphery of a roller Y, and as it revolves, by acting against the fixed or ledger blade Z, fixed above in a transverse position over which the paper passes, cut or divide the paper into sheets as required, which fall upon the continuous felt below, and are thus delivered to the table attached. The length of the sheet is regulated by a pair of conical-pullies A*, one of which communicates with or drives the revolving-cutter.

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Fig. 3, sheet 2, shews a mode of couching or detaching the paper from the moulding-cylinder G by the substitution of a continuous or endless web of wire instead of felting, and by which the paper is conducted by the drying-cylinder. To use this wire the felt is only continued through the pressing-rollers and drying-cylinder. G is the moulding-cylinder; I, the couching-roller; J J, the wire; J, a pressing-roller, kept against the cylinder L by a lever and weight; K, another pressing-roller; L, part of the drying-clyinder; and H H, the felt.

In witness whereof I, the said Lemuel Wellman Wright, have hereunto set my hand and seal, the fourteenth day of December, in the year of our Lord one thousand eight hundred and forty-three.

[L. S.] LEMUEL W. WRIGHT.

W. E. Lycett, *A Master Extraordinary in Chancery.*

And be it remembered that, on the same fourteenth day of December, in the year above-mentioned, the aforesaid Lemuel Wellman Wright came before our lady the Queen in her chancery, and acknowledged the specification aforesaid, and all and everything therein contained, in form above-written. And also the specification aforesaid was stamped according to the tenor of the *stamped according to the tenor of the* statute in that case made and provided.

Inrolled the fifteenth day of December, in the year above written.

(Here follows 3 diagrams marked page 633.)

634 DEFT'S' EXHIBIT 12.—K. G. W., *Ex'r.*

[COAT OF ARMS.]

A. D. 1844.] [No. 10252.

Specification of Moses Poole.—Manufacture of paper.—Filed May 31st, 1867.—Price 4d.

[Patent stamp, four pence, canceled, and coat of arms.]

A. D. 1844.] [No. 10252.

Manufacture of paper.—Poole's specification.

To all to whom these presents shall come I, Moses Poole, of Lincoln's Inn, in the county of Middlesex, gentleman, send greeting:

Whereas Her present most excellent Majesty Queen Victoria, by her letters-patent under the great seal of Great Britain, bearing date at Westminster, the tenth day of July, in the eighth year of her reign, did, for herself, her heirs, and successors, give and grant unto me, the said Moses Poole, her especial licence, full power, sole privilege and authority, that I, the said Moses Poole, my ex'ors, adm'ors, and assigns, or such others as I, the said Moses Poole, my ex'ors, adm'ors, or assigns, should at any time agree with, and no others, from time to time and at all times during the term of years therein expressed, should and lawfully might make, use, exercise, and vend, within England, Wales, and town of Berwick-upon , and in the isles of Jersey, Guernsey, Alderney, Sark, and Man, and also in all Her said Majesty's colonies and plantations abroad, the invention of "improvements in the manufacture of paper," communicated to me by a certain foreigner residing abroad; in which said letters-patent is contained a proviso that I, the said Moses Poole, shall cause a particular description of the nature of the said invention, and in what manner the same is to be performed, to be inrolled in Her said Majesty's high court of chancery, within six calendar months next and immediately after the date of the said in part recited letters-patent, as in and by the same, reference being thereunto had, will more fully and at large appear.

635 Now know ye that, in compliance with the said proviso, I, the the said Moses Poole, do hereby declare that the nature of the said invention, and the manner in which the same is to be performed, are fully described and ascertained in and by the following statement thereof, (that is to say:)

The improvements in the manufacture of paper consists in the employment of the broom-plant reduced to a pulpy state, as will be more particularly described. There are various kinds of the broom, but the one most perferable is the common broom, because it is obtained in greater quantity. It may be used either in a green or dried state, either by being first steeped in water or not. The branches of the plant are to be first submitted to violent crushing or bruising by any suitable machinery. After the plant has been subject for some time to the crushing or grinding process, the ligneous or woody parts may be readily separated from the filamentous parts, and should be subject to a further process of grinding before they are mixed with the filamentous parts. In the process of grinding or crushing, the plant should be immersed in water either hot or cold,

and should be continually changed, but I prefer that the water should be heated to about thirty or thirty-five degrees of Reaumer. This crushing process should be continued until the water in which it is immersed flows away without any color. The pulpy matter is then to be submitted to great pressure in order to force out the water contained therein, and afterwards submitted to a lessive of lime with or without a quantity of soda, according to the quality of the paper to be made. The strength of the lessive I generally use, is about ten pounds of soda to about two hundred pounds of the pulp prepared as above described. It is then put into a washing-mill in order to have it untwisted and thoroughly washed, taking care to remove all the woody parts which float on the surface. The pulp is then again submitted to pressure and divided into small parcels till it is in a fit state to be bleached, *and is to be bleached*, and is to be then exposed to the action of chlorine, either in vapor or in a liquid state. In putting it into a bath of liquid chlorine, the chlorine should be of about twenty-five degrees of Reaumer, and after having remained in this bath about twenty-five minutes, I add about one-quarter of a pint of muriatic acid for every two hundred pounds of pulp; in this state it is allowed to rest about six hours, and the pulp is in a fit state to be manufactured into paper; the process will be complete. The quantities of chemical proportions may be varied according to the season, and also to the state of dryness in which the plant is.

Having thus described the nature of the invention, and the manner of performing the same, I would have it understood that I do not confine myself to the precise details described herein of preparing
636 the materials, nor to the means of bleaching, as other modes of bleaching may be used. But what I claim is the preparation and employment of a pulpy matter obtained from the broom-plant to the manufacture of paper.

In witness whereof I, the said Moses Poole, have hereunto set my hand and seal, this tenth day of January, in the year of our Lord one thousand eight hundred and forty-five.

[L. S.] MOSES POOLE.

And be it remembered that, on the tenth day of January, in the year of our Lord, 1845, the aforesaid Moses Poole, esquire, came before our said lady the Queen in her chancery, and acknowledged the specification aforesaid, and all and every thing therein contained and specified in form above written. And also the specification aforesaid was stamped according to the tenor of the statute made for that purpose. LYNCH.

Enrolled the tenth day of January, in the year of our Lord one thousand eight hundred and forty-five.

637 DISCLAIMER.

In the matter of letters-patent granted to Moses Poole, of the patent-office, Searle street, in the county of Middlesex, gentleman, for an invention communicated to him by certain foreigners, residing abroad, of "improvements in the manufacture of paper," and bearing date at Westminister, the tenth day of July, one thousand eight hundred and forty-four.

Disclaimer and memorandum of alteration entered by the said Moses Poole, pursuant to the provisions of an act passed in the fifth and

sixth years of the reign of His late Majesty King William the Fourth, intitled "An act to amend the law touching letters-patent for inventions."

I, the said Moses Poole, do hereby declare that, since the inrollment of the specification of the said invention, it has been discovered that the explanation of the method pursued for the preparation of the different parts of the plant is not so clear as it was intended to have been, and for this reason I, the said Moses Poole, do hereby disclaim the following part of my said specification, that is to say, all the words after the words "steeped in water or not," to where the claiming clause begins with the words "Having thus described the nature of the invention." And I do hereby alter the said specification by substituting in lieu of the parts so disclaimed as aforesaid, the following words, that is to say: "By experience in the manufacture of paper from the broom, it has been found adviseable to separate, by any convenient means, the stalks from the sprigs, and to reduce them separately to the state of pulp or half-stuff by crushing or bruising with any suitable machine. In the process of crushing or bruis ng, the plant should be immersed in water either hot or cold, which should be continually changed, but I prefer that the water should be hea ed to about 30° or 35° of Reaumer; this crushing process should be co tinued until the water flows away quite clear. The half-stuff is then to be drained and afterwards boiled in a caustic-lime ley, with or without a quantity of soda, according to the quality of the paper to be made. The half-stuff is then put into a washing-engine and reduced to a state of pulp, and afterwards manufactured into brown paper in the ordinary way. For white paper
638 the strength of the ley I generally use is about ten pounds of lime to two pounds of soda, for about one hundred pounds of the half-stuff prepared as above described. For white paper, the pulp from the washing-engine is to be drained or pressed and divided for bleaching, and is to be then exposed to the action of chlorine, either in vapour or in a liquid state, as in the ordinary manufacture of paper from rags. In this state it is allowed to rest about six hours, and the pulp is in a fit state to be manufactured into white paper. The quantities of chemical proportions may be varied according to the season, and also to the state of dryness in which the plant is."

In witness whereof I, the said Moses Poole, hereunto set my hand and seal, this twenty-sixth day of April, one thousand eight hundred and forty-five.

MOSES POOLE. [L. S.]

This is to certify that the within-named Moses Poole, of the patent-office, Searle street, in the county of Middlesex, gentleman, has applied to me for leave to enter the above-written disclaimer and memorandum of alteration of part of the specification of a certain invention for which letters-patent were duly granted to him under the great seal of Great Britain, dated at Westminster, the tenth day of July, one thousand eight hundred and forty-four, and the specification of which was enrolled on the tenth day of January, in the year of our Lord one thousand eight hundred and forty-five. And on considering the said application, I directed him to advertize his said disclaimer and alteration in the London Gazette, and in the Times and Morning Chronicle newspapers; and such advertizements have been duly made, namely, in the said Gazette and Times, and Morning Chronicle newspapers, in the Gazette of March the eighteenth, and in the Times of March the

fifteenth, and in the Morning Chronicle of March the fourteenth, in the year of our Lord one thousand eight hundred and forty-five.

And no objection having been duly made to the said petition, I have accordingly given leave to the said Moses Poole to file his disclaimer and memorandum of alteration, pursuant to the statute passed in the fifth and sixth year of the reign of His late Majesty King William the Fourth, intituled An act to amend the law touching letters-patent for inventions.

FRED. THESIGER.

TEMPLE, *April 30th*, 1845.

639 ROSE. And be it remembered that, on the twenty-sixth day of April, in the year of our Lord 1845, the aforesaid Moses Poole came before our said lady the Queen in her chancery, and acknowledged the disclaimer aforesaid, and all and every thing therein contained and specified, in form above written. And also the disclaimer aforesaid was stamped according to the tenor of the statute made for that purpose.

Enrolled the seventh day May, in the year of our Lord one thousand eight hundred and forty-five.

London: Printed by George Edward Eyre and William Spottiswoode, printers to the Queen's Most Excellent Majesty. 1856.

640 DEF'TS' EXHIBIT 13.—K. G. W., *Ex'r.*

[COAT OF ARMS.]

A. D. 1852.] [No. 13979.

Specification of Jean Theodore Coupier and Marie Amedée Charles Mellier. Manufacture of paper.

[Patent stamp, four pence canceled, and coat of arms.]

A. D. 1852.] [No. 13979.

Manufacture of paper. Coupier and Mellier's specification.

To all to whom these presents shall come we, Jean Theodore Coupier and Marie Amedée Charles Mellier, of Maidstone, in the county of Kent, gentlemen, send greeting:

Whereas Her present, most excellent Majesty Queen Victoria, by her royal letters-patent under the great seal of the United Kingdom of Great Britain and Ireland, bearing date at Westminster, the twenty-third day of February, in the fifteenth year of Her Majesty's reign (one thousand eight hundred and fifty-two,) did, for herself, her heirs and successors, give and grant to the said Jean Theodore Coupier and Marie Amedée Charles Mellier, their ex'ors, adm'rs, and assigns, her especial licence, full power, sole privilege and authority, that they, the said Jean Theodore Coupier and Marie Amedée Charles Mellier, their ex'ors, adm'ors, and assigns, and such others as they, the said Jean Theodore Coupier and Marie Amedée Charles Mellier, their ex'ors, adm'ors, and assigns, should at any time agree with, and no others, from time to time and at all times during the term of years therein expressed, should and lawfully might make, use, exercise, and vend, within England, Wales,

and the town of Berwick-upon-Tweed, and in the islands of Guernsey, Jersey, Alderney, Sark and Man, and also in Her said Majesty's colonies and plantations abroad, our invention of "certain improvements in the manufacture of paper;" in which said letters patent there is contained a proviso, that we, the said Jean Theodore Coupier and Marie Amedée Charles Mellier, shall cause a particular description of the nature of their said inventions, and in what manner the same is to be performed, by an instrument in writing under our hands and seals, or under
641 the hand and seal of one of us, to be enrolled in Her said Majesty's high court of chancery within six calendar months next and immediately after the date of the said in part recited letters-patent, as in and by the same, reference being thereunto had, will more fully and at large appear:

Now know ye that, in compliance with the said proviso, we, the said Jean Theodore Coupier and Marie Amedee Charles Mellier, do hereby declare the nature of our said invention, and the manner in which the same is to be performed, are particularly described and ascertained in and by the following statement thereof, (that is to say:)

The first part of our invention, which is more especially applicable to the treatment of straw, and generally the herbaceous matters and barks of some trees, as willow, osier, chestnut tree, and others, has for its object the making pulp therefrom, by chemically acting thereon, as hereinafter explained, and dispensing with the use of machinery theretofore employed when reducing such matters to pulp to be used in the manufacture of paper.

And the invention consists of employing a solution of hydrate of soda or potash of such strength and in such manner as will, together with the other means hereinafter described, reduce the vegetable matters into pulp,

And in order that this part of our invention may be most fully understood and readily carried into effect, we will proceed to describe the means pursued by us:

DESCRIPTION OF THE PROCESS.

Straw or such like vegetable matter is to be cut up by a chaff-cutting machine before proceeding to operate according to our invention, and if bark or such like vegetable matters are to be employed, the same is to be cut into chips or crushed. And such vegetable matters are then to be treated according to our invention, which commences with a process of employing a boiling solution of hydrate of soda or potash, and it is important that the solution should be of considerable strength, and we have found a solution of hydrate of soda or potash, marked from seven to ten degrees of Baumé, to be the best strength; and we would state that a material departure from that strength either above or below will result in a failure to obtain the beneficial operation, which is consequent on the use of such alkaline solutions, as herein described. The straw or vegetable matter is to be put in an open tub or vessel with a false bottom perforated with numerous small holes. This tub or vessel is covered when the process is being carried on; through the cover there is a pipe, with a rose head thereon, the other end of such pipe descending into a close iron vessel, and nearly to the bottom thereof; in this
642 iron vessel, which is capable of containing about sixty or seventy gallons, the alkaline solution is to be placed, and by means of high-pressure steam from a suitable steam-boiler, passing through a worm or coil in the iron vessel, the liquor is boiled, and by a slight escape of

steam from the worm is to be forced up the pipe and through the rose head, by which streams of the boiling liquor will be forcibly thrown on the straw or vegetable matter lying on the false bottom of the tub. When one filling of the iron vessel has been forced into the tub, and distributed over the vegetable matter herein, the iron vessel is again to be filled, and such further quantity is to be forced over and through the rose-head by the steam, when the iron vessel is to be again filled and again emptied by the steam, until the quantity of alkaline solution proper for the quantity of vegetable matter in the tub has been forced by the steam into the tub. It should be understood that the steam is shut off from the iron vessel before running in fresh quantities of the alkaline solution. When the whole of the liquor required has thus been forced into the tub containing the vegetable matter, a circulation of the liquor is to be caused to take place in the following manner. The cock on another pipe hereinafter described, is to be opened, and to remain open during the circulation; from the bottom of the tub, raised some few inches above the top of the iron vessel, proceeds another pipe, as stated, with a cock on it, and also a self-acting valve opening into the iron vessel, by which a quantity of the liquor is run back into the said iron vessel, the steam being turned off for a time to allow of the same, and to be again turned on to drive over the liquor, the valve closing by the pressure of the steam, and preventing the liquor being forced under the false bottom while it is being blown upon the straw; and this process of circulation is to be continued for about eight or ten hours, when the cock on the pipe with the valve is shut, and the liquor is to be drawn off by another pipe at the bottom of the tub or vessel. Water is then to be run into the close iron vessel, and is to be forced out therefrom by steam through the pipe and rose-head, as explained, and on to the straw or vegetable material in the vessel, and such process of wash waters are to be repeated till the water coming off does not indicate a greater strength than one degree of Baumé; cold water is then to be run into the tub from any convenient source till it comes off clear. The quantity of alkaline solution employed by this means is at the rate of about thirty to forty gallons of the strength above mentioned for each hundred weight of vegetable matter. The vegetable material being well washed, as above described, is then put into a bath of hypochlorite of alumina (in order that it may be bleached and the fibres disaggregated,) where it remains for twelve or eighteen hours, being stirred from time to time. The hypochlorite is used at the rate of about twenty or twenty-five per cent. by weight of the
643 vegetable matter, using about seventy gallons of water for each hundred weight of vegetable matter; the solution of hypochlorite alumina will, therefore, be of a strength of about three degrees of Baumé, and we prefer to employ a stronger solution rather than a weaker one.

We would remark that, although we prefer to use hypochlorite of alumina, a solution of other hypochlorite of like strength may be used. Hypochlorite of alumina may be obtained by means of double decomposition, in dissolving sulphate of alumina as neutral as possible in a solution of hypochlorite (common chloride) of lime; the proportion depending on the quality of these two substances will vary, but generally about thirty-five of sulphate of alumina to one hundred of the hypochlorite of lime will be required. The vegetable matter, which is now reduced into what is called half-stuff and of good color, is to have the liquors strained off; this pulp is to be well washed, by preference in boiling water, in order completely to remove the hypochlorite and com-

plete the disaggregation of the fibres, and then it remains to beat it in the ordinary beating-engines, and to make it in paper alone or in combination with the pulp obtained from rags.

In order to carry on our invention as economically as may be, we cause the alcaline liquor drawn off and the first wash-waters to be evaporated; a resinous soap is thus obtained, which being mixed with charcoal dust or sawdust, or alone, produces a fuel, from which may be obtained gas by destructive distillation in the ordinary manner; or the same may be burned as fuel, and from the ashes by lixiviation a considerable part of the alkali will be obtained for further use.

We must observe that the above described process is also applicable to flax, waste cotton, waste tows of hemp, jute, or surate, but this does not dispense reducing them in half-stuff by the means usually employed. We must also observe that the hydrate of soda or potash is obtained by slacking a proper quantity of lime in a solution of common soda, ashes, or potash, and drawing of the clear liquors.

We will now describe the second part of our invention, which consists of employing nitric acid of such strength and in such manner that wood may be reduced to pulp thereby, and the same bleached, as hereinbefore described, without the necessity for mechanical operations, and by reason of using nitric acid of the strength and in the manner hereinafter mentioned, other useful products are obtained, as hereinafter described.

In carrying on this part of our invention we take the woods reduced to shavings; pine, beech, ash, and elm are peculiarly suited for this purpose, though others may be employed. In carrying on the
644 process we use two tubs, each having a false perforated bottom, on to which the shavings of wood are to be pressed, and on to the shavings is placed a perforated cover, leaving about eight inches of empty space. Between such perforated cover and the close cover to the top of each tub, we use at the rate of eighty per cent. by weight or more of white nitric acid (thirty-six degrees of Baumé) of the vegetable matter to be operated on according to our invention, and mix such acid with water, reducing the strength to about five or six degress Baumé. We run the proper quantity of diluted acid, according to the quantity of wood to be operated on, into one of the tubs, and allow the same to act on the wood for about four hours, when the liquid is to be brought to ebullition by means of free steam for about two hours, during which process fumes of nitreous acid will pass off, which are caused to be introduced into the other tube below the false perforated bottom by a suitable pipe fixed to the cover of the first tub, by which means the shavings of wood (which are to be damped before) will be subjected to the fumes of nitreous acid, and there is to be a stream of atmospheric air forced into the tub below the false bottom, the object of which is to convert part of the fumes into hyponitric acid. The liquid having been drained off from the shavings of wood in the first tub, they are to be well washed with water, and such shavings are then to be subjected to the action of a solution of hydrate of soda or potash of a strength of about two degrees of Baumé, in which solution they are to be boiled for about two hours; they are again to be well washed with water, after which the fibres of the wood are to be subjected to a like process of hypochlorite of alumina, as above described, but in proportion of two per cent. in place of twenty-five per cent., when the fibres are to be washed, as in the former case, and they will be ready for use, either alone or with the pulp from rags. The liquor drawn off from the first tub is to be placed in the second tub, into which the fumes of nitreous acid from the first tub have been

passed, such liquor being strengthened by an addition of nitric acid in the proportion of forty per cent. by weight of the raw material, and it is to be operated on in the same manner, sending his fumes of nitreous acid in the first tub, filled again with new damped shavings, and in this manner may the said liquor be used several times till it becomes too much thickened, when it is to be evaparated in earthenware vessels heated by a water-bath. The liquor then will be reduced, and by cooling crystallized oxalic acid will be obtained, which may be purified in the ordinary manner, and the mother-waters will contain another acid analogous to the nitropieric acid, which is available for dyeing wo'llen and silks.

Having thus described the nature of our invention, and the manner in which the same is to be performed, we would have it understood
645 that we do not confine ourselves to the details herein described so long as the peculiar character of either part of our invention be retained; but what we claim is—

First. The mode herein described of reducing vegetable matters into pulp by means of a solution of hydrate of soda or potash, and the use of hypochlorites. And we also claim the mode herein described of employing hypochlorites of alumina for bleaching vegetable matters in the process of manufacturing paper.

And secondly, we claim the mode herein described of employing nitric acid in manufacturing other pulp, and obtaining other products.

In witness whereof I, the said Marie Amedée Charles Mellier, have hereunto set my hand and seal this twenty-first day of August, one thousand eight hundred and fifty-two.

[L. S.] MARIE AMÉDÉE CHARLES MELLIER.

CROSBY. And be it remembered that, on the twenty-first day of August, in the year of our Lord 1852, the aforesaid Marie Amedée Charles Mellier, came before our said lady the Queen in her chancery, and acknowledged the specification aforesaid, and all and everything therein contained and specified, in form above written. And also the specification aforesaid was stamped according to the tenor of the statute made for that purpose.

Enrolled the twenty-third day of August, in the year of our Lord one thousand eight hundred and fifty-two.

London: Printed by George Edward Eyre and William Spottiswoode, printers to the Queen's Most Excellent Majesty. 1856.

646 DEF'TS' EXHIBIT 14—K. G. W., *Ex'r.*

The U. States Patent-Office to all persons to whom these presents shall come, greeting:

This is to certify, that the annexed is a true copy from the records of this office of re-issued letters-patent granted William F. Ladd and Morris L. Keen, assignees of Charles Watt and Hugh Burgess, Oct. 5, 1858, No. 608.

In testimony whereof I, D. P. Holloway, Commissioner of Patents, have caused the seal of the Patent-Office to be hereunto affixed, this sixth day of May in the year of our Lord one thousand eight hundred and sixty-three and of the Independence of the United States the eighty-seventh.

[SEAL.] D. P. HOLLOWAY.

647 Re-issue No. 608.

The United States of America to all to whom these letters-patent shall come:

Whereas, William F. Ladd of New York, N. Y., & Morris L. Keen of Philadelphia, Pa., assignees (through mesne assignments) of Charles Watt & Hugh Burgess, of London, England, have alleged that said *said* Charles Watt & Hugh Burgess, did invent a new and useful improvement in manufacture of paper from wood (for which letters-patent were issued to said Watt & Burgess, on the 18th day of July, 1854; antedated August 19th, 1853, which letters having been surrendered by said assignees, the same have been canceled & new letters ordered to issue to them on an amended specification) which they stated had not been known or used before their application; had made oath that they were subjects of the Queen of Great Britain; that they did verily believe that they were the original and first inventors or discoverers of the said improvement, and that the same hath not, to the best of their knowledge and belief, been previously known or used; said Ladd & Keen, having paid into the Treasury of the United States the sum of fifteen dollars, and presented a petition to the Commissioner of Patents, signifying a desire of obtaining an exclusive property in the said improvement, and praying that a patent may be granted for that purpose:

These are, therefore, to grant, according to law, to the said William F. Ladd & Morris L. Keen, their heirs, administrators, or assigns, for the term of fourteen years from the nineteenth day of August, one thousand eight hundred and fifty-three, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said improvement, a description whereof is given in the words of the said William F. Ladd & Morris L. Keen, in the schedule hereunto annexed, and is made part of these presents.

In testimony whereof, I have caused these letters to be made patent, and the seal of the Patent-Office has been hereunto affixed.

Given under my hand, at the city of Washington, this fifth day of October, in the year of our Lord one thousand eight hundred and fifty-eight, and of the Independence of the United States of America the eighty-third.

JACOB THOMPSON,
Secretary of the Interior.

Countersigned and sealed with the seal of the Patent-Office.
[L. S.]

J. HOLT,
Commissioner of Patents.

648 The schedule referred to in these letters-patent & making part of the same.

To all whom it may concern:

Be it known that Charles Watt, and Hugh Burgess, of London, England, did invent, make, and apply to use, certain improvements in pulping and disint*reg*ating vegetable substances, for which letters-patent have been granted to them by Her Majesty the Queen of Great Britain, bearing date the 19th August, 1853, and we do hereby declare that the following is a full, clear, and exact description of said invention, and the mode of carrying out the same.

The wood or vegetable substances upon which it is intended to oper-

ate by this process, should first be reduced to very fine shavings or cuttings; the finer the better. This may be done in any suitable machine. The shavings or vegetable substances, are then to be boiled in a solution of caustic alkali; the strength of which being dependent on the nature of the vegetable substance operated on, can only be learned by experience. By the "nature of vegetable substance" is meant its gummy or resinous nature, or its absence from such substance. For deal or fir wood, which contain resinous matter, a so'olution of alkali of the strength indicated by 12° of the English hydrometer answers very well. The length of time necessary for this part of the process is somewhat dependent on the nature of the vegetable substance to be treated; that is, its resinous or gummy nature. And boiling in a solution of caustic alkali under pressure, is of considerable importance. By the words "under pressure" is meant a pressure at, near, or above 300 degrees
649 of Fahrenheit's scale—the ordinary pressure used by us, being from 300 to 500 degrees, in accordance with the nature of substance to be treated.

The shavings or vegetable substances being pulped are then to be well pressed and washed. The pressings and washings may be saved and evaporated down and burned in a furnace, suitably constructed, when they are again available for same purpose.

The damp mass of materials being pulped are now to be exposed to the action of chlorine, or the compounds of chlorine with oxygen, (and can then be made into white paper if the materials used was not of a highly resinous nature. If the material under treatment was of highly resinous character it should then be washed and placed in a dilute solution of caustic alkali, warm preferred. The vegetable substance then falls into a dark pulpy mass, and when washed, can be bleached by any desirable method known. Good white pulps will be obtained by the above processes, according to the resinous or non-resinous properties of materials under treatment, and the pulps will retain their clear appearence for any length of time in their pulpy state, or after they are made into paper.

The above-described gasing or bleaching process, is conveniently effected by placing the damp shavings, vegetable substance, or pulpy mass, on racks or drawers, about nine inches apart, one above another, arranged in a chamber and allowing the chlorine, or the compounds of chlorine with oxygen, to enter the chamber and fill it. Of the
650 compounds of chlorine with oxygen, we prefer that known as protoxide of chlorine, or hypochlorous or chlorous acid, or euchlorine. If found more convenient, the chlorine or the compounds of chlorine with oxygen may be used in aqueous solution instead of the gaseous form; as soon as the shavings, vegetable substance, or pulpy mass have been sufficiently acted upon, the time required being as to their resinous or non-resinous properties, they may be removed, and the hydrochloric acid, which is the result of the above process, removed by washing and well pressing the materials under process. This should be done with as little water as possible, as the acid may be saved, and made use of for the reproduction of chlorine.

When the pulp obtained by the above described process has been freed from its alkali by pressing and washing (which pressings and washings liquor may be saved as before described,) it may by bleached by the usual process, or as we prefer, by the chlorite or hypochlorite of soda or potash, liberating the chlorous or hypochlorus acid by hydochloric acid.

Having thus fully described the invention of said Watt and Burgess, what we claim as of their invention and desire to secure by letters-patent

is, the pulping or disintegrating of shavings of wood and other similar vegetable matter for making paper in the manner substantially as herein described, according to the nature of the vegetable substance to be treated.

WILLIAM F. LADD.

Witnesses to sig. of William F. Ladd—
JAS. MONCREIF.
GEORGE W. WILLIS.

651 MORRIS L. KEEN.

Witnesses to signature of Morris L. Keen—
W. D. EVANS,
EPHRAIM MILLER.

(Indorsed:) 5 Oct., 1858. Patent to Ladd & Keen, assignees of Watt & Burgess. Re-issue of patent of 18th July, 1854. Exhibit 14. K. G. W., examiner. Filed May 21st, 1867.

652 (DEF'TS' EXHIBIT 17.—K. G. W., *Ex'r.*)

The U. States Patent-Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the records of this office of the letters-patent granted Coupier & Mellier, August 2d, 1853, No. 9910.

In testimony whereof I, D. P. Holloway, Commissioner of Patents, have caused the seal of the Patent-Office to be hereunto affixed, this twenty-second day of March, in the year of our Lord one thousand eight hundred and sixty-five, and of the Independence of the United States the eighty-ninth.

[SEAL.] D. P. HOLLOWAY.

653 No. 9910.

The United States of America to all to whom these letters-patent shall come:

Whereas Jean Theodore Coupier and Marie Amedee Charles Mellier, of Paris, France, have alleged that they have invented a new and useful improvement in the manufacture of paper-stuff, which they state has not been known or used before their application; have made oath that they are citizens of France; that they do verily believe that they are the original and first inventors or discoverers of the said improvement, and that the same hath not, to the best of their knowledge and belief, been previously known or used; have paid into the Treasury of the United States the sum of three hundred dollars, and presented a petition to the Commissioner of Patents, signifying a desire of obtaining an exclusive property in the said improvement, and praying that a patent may be granted for that purpose:

These are, therefore, to grant, according to law, to the said Jean Theodore Coupier & Marie Amedee Charles Mellier, their heirs, administrators, or assigns, for the term of fourteen years, from the seventh day of May, one thousand eight hundred and fifty-one, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said improvement, a description whereof is given in the words of the said Coupier & Millier, in the schedule hereunto annexed, and is made part of these presents.

In testimony whereof I have caused these letters to be made patent, and the seal of the Patent-Office has been hereunto affixed.

Given under my hand, at the city of Washington, this second day of August, in the year of our Lord one thousand eight hundred and fifty-three, and of the Independence of the United States of America the seventy-eighth.

ROBERT McCLELLAND,
Secretary of the Interior.

Countersigned and sealed with the seal of the Patent-Office.
[L. S.] CHA'S MASON,
Commissioner of Patents.

654 The schedule referred to in these letters-patent, and making part of the same.

To all to whom these presents shall come:

Be it known that we, Jean Theodore Coupier and Marie Amedee Charles Mellier, of Paris, in the Republic of France, have invented a new and improved method of reducing fibrous vegetable substances to pulp fit for the purpose of making white paper, and that the following is a full and exact description thereof, reference being had to the accompanying drawings which make part of this specification.

Our process consists in general in the treatment of straw, and all crude or new herbaceous matters, with a solution of hydrate of soda or potash, of such strength and in such a manner as will, together with the other means hereinafter described, reduce them to pulp, & thereby dispensing almost entirely with machinery as com'only employed for similar purposes.

This process is simple, effecacious, & economical, but the success depends entirely on the strength of the liquor employed & the purity of the hydrat' of soda or potash, for we have discovered that, usually in attempts hitherto made to obtain pulp from such materials, and to bleach the same, the failure has been in part owing to the presence of lime, (a very common occurrence,) in the solution of soda and potash; where lime is present the pulp will always retain a yellowish or dingy color.

We are aware that alkalies have been used before for treating vegetable fibre, but in such cases the alkalies have either not been employed in their caustic state, or the lime which has been present has rendered every such attempt to make white paper from straw entirely unsuccessful.

655 Straw or such like vegetable matter is to be cut up by a chaff-cutting machine before proceeding to operate according to our invention; and if bark or such like vegetable matters are to be employed the same is to be cut into chips or crushed, and such vegetable matters are then to be treated according to our invention, which commences with a process of employing a boiling solution of hydrate of soda or potash; and it is important that the solution should be of considerable strength, and we have found a solution of hydrat' of soda or potash marking from eight to ten degrees of Baumé to be the best strength, and we would state that a material departure from that strength, either above or below, will result in a failure to obtain the beneficial operation which is consequent on the use of such alkalines solutions as herein described.

The straw or vegetable matter is to be put into an open tub or vessel,

as seen in the accompanying drawing A, with a false bottom, shown in the dotted lines B B B B, perforated with numerous small holes. This tub or vessel is covered when the process is being carried on. Through the cover there is a pipe, G, with a rose-head, I & L, thereon, the other end of such pipe descending into a close iron vessel, E, and nearly to the bottom thereof. In this iron vessel, which is capable of containing about 60 to 70 gallons, the alkaline solution is to be placed, and by means of high-pressure steam from a suitable steam-boiler passing through a worm or coil, F, in the iron vessel E, the liquor is boiled, and by a slight escape of steam from the worm is to be forced up the pipe G, and through the rose-head I & L, by which streams of the boiling liquor will be forcibly thrown on the straw or vegetable matter lying on the false bottom of the tub A. When one filling of the iron
656 vessel has been forced into the tub and distributed over the vegetable matter herein, the iron vessel is again to be filled and such further quantity is to be forced over and through the rose-head I & L by the steam when the iron vessel is to be again filled and again emptied by the steam till the quantity of alkaline solution proper for the quantity of vegetable matter in the tub has been forced by the steam into the tub. It should be understood that the steam is shut off from the iron vessel before running in fresh quantities of the alkaline solution. When the whole of the liquor required has thus been forced into the tub containing the vegetable matter a circulation of the liquor is to be caused to take place in the following manner: The stop-cock D on the pipe R, hereinafter described, is to be opened, and to remain open during the circulation.

From the bottom of the tub A, raised some few inches above the top of the iron vessel E, proceeds the pipe R, with the stop-cock D. This pipe has on its end, which enters the vessel E, a self-acting valve, M, opening into the iron vessel, by which a quantity of the liquor is run back into the said iron vessel E, the steam being turned off for a time to allow the entering of the liquor, and to be again turned on to drive over the liquor, the valve closing by the pressure of the steam and preventing the liquor being forced under the false bottom while it is being forced up through the pipe G upon the straw, and this process of circulation is to be continued for about eight or ten hours, when the stop-cock D on the pipe R is shut and the liquor is to be drawn off by another pipe, C, at the bottom of the tub A. Water is then to be run into the close iron vessel, and is to be forced out therefrom by steam through the pipe G and rose-head, as explained, and on to the straw or vegetable material in the vessel; and such processes of wash-wa-
657 ters are to be repeated till the water coming off through the pipe C does not indicate a greater strength than one degree of Baumé. Cold water is then to be run into the tub from any convenient source till it comes off clear.

The quantity of alkaline solution employed by this means is at the rate of about thirty to forty gallons of the strength above mentioned for each cwt. of vegetable matter.

The vegetable material being well washed, as above described, is then put into a bath of hypochlorite of allumina, (in order that it may be bleached and the fibres loosened,) where it remains for twelve to eighteen hours, being stirred from time to time. The hypochlorite is used at the rate of about twenty-five per cent. by weight of the vegetable matter, using about seventy gallons of water for each cwt. of vegetable matter. The solution of hypochlorite of allumina will, therefore, be of a strength about three degrees of Baumé, and we prefer to employ a stronger solution rather than a weaker one.

This degree of strength we have determined after many experiments as being the only one which will produce a uniformly white pulp from the material prepared as above described, and to our knowledge this solution of hypochlorites was never used, at the degree as we have indicated above, for bleaching pulp from straw and other vegetable matter. In all patents which have been granted for making paper from said vegetable matters, the bleaching-liquor has never been mentioned at such a high degree as it is used by us.

The strength at which bleaching-liquor is employed in the ordinary mode of making paper varies from $\frac{1}{4}$ to $\frac{1}{2}$ of a degree when it is diluted in the necessary quantity of water contained in the engine.

We would also remark that, although we prefer to use hypochlorite of al'umina, a solution of other hypochlorites of like strength may be used.

658 The vegetable matter which is now reduced into what is called half-stuff, and of good color, is to have the liquors strained off. This pulp is to be well washed, (by preference in boiling water in order completely to remove the hypochlorite and complete the disaggregation of the fibres,) and there it remains to beat it in the ordinary beating-engines, and to make it in paper alone or in combination with the pulp obtained from rags. In order to carry out our invention as economically as may be, we cause the alkaline liquor drawn off, and the first wash-waters to be evaporated. A resinous soap is thus obtained, which being mixed with charcoal dust, or sawdust, or alone, produces a fuel from which may be obtained gas by distructive distillation in the ordinary manner, or the same may be burned as fuel, and from the ashes by lixiviation, a considerable part of the alkali will be obtained for further use.

We must observe that the above-described process is also applicable to flax, waste cotton, waste tow of hemp, jute or surat, but this does not dispense with reducing them in half-stuff by the means usually employed.

The important features of our invention are—

First. The employment of the pure hydrates of soda or potash in the reduction of the straw and similar vegetable matters into pulp, for the special reasons set forth above, and using such hydrates at or about the degree of strength mentioned, viz, 8° to 10° Baumé.

Second. The manner of using such hydrates upon the straw or other similar vegetable matters, by means of the apparatus above described, or any other substantially the same, and

Third. The employment of the hypochlorites of the degree of strength 3° Baumé for bleaching the pulp obtained by our process.

659 We do not claim as our invention the use of alkalies in the treatment of vegetable fibre for the preparation of paper-pulp, nor do we claim the individual parts of the apparatus employed in our process, but what we do claim is—

First. The process herein described of reducing straw and other similar vegetable matters into pulp for making paper, said process consisting in applying and circulating the solution of the hydrate of soda or potash in the manner above mentioned, and at or about the strength indicated, in combination with the apparatus substantially as described, by which means we are enabled to effect the reduction of a very large amount of pulp with a comparatively small quantity of liquor, & preserve also the requisite strength in the liquor, and also obtain facility for its evaporation.

We do not claim the use of hypochlorites for bleaching pulp, but what we do—

Secondly, claim is, the employment of hypochlorites in the process of bleaching straw or similar vegetable matter when prepared as above, for the purpose of making paper, substantially as herein set forth, that is to say, using them at or about the strength set forth in the specification, viz, 3° Baumè, and we claim this degree of strength only when employed upon such materials.

JEAN THEODORE COUPIER.
MARIE AMEDEE CHARLES MELLIER.

Witnesses:
S. G. GOODRICH.
W. S. CHASE.
Ex'd. A. T.

(Here follows diagram marked page 659.)

660 DEF'TS' EXHIBIT 16.—K. G. W., *Ex'r.*

The U. States Patent-Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy, from the records of this office, of the letters-patent granted Wooster and Holmes, August 3d, 1830.

In testimony whereof I, T. C. Theaker, Commissioner of Patents, have caused the seal of the Patent-Office to be hereunto affixed, this thirty-first day of May, in the year of our Lord one thousand eight hundred and sixty-six, and of the Independence of the United States the ninetieth.

[SEAL.] T. C. THEAKER.

661 The United States of America to all to whom these letters-patent shall come:

Whereas Lewis Wooster & Joseph E. Holmes, citizens of the United States, have alleged that they have invented a new and useful improvement in the mode of making or manufacturing paper for writing, printing, wrapping, & boards, from wood, which improvement, they state, has not been known or used before their application; have made oath that *he does* verily believe that *he is* the true inventor' or discoverer' of the said improvement; have paid into the Treasury of the United States the sum of thirty dollars, delivered a receipt for the same, and presented a petition to the Secretary of State, signifying a desire of obtaining an exclusive property in the said improvement, and praying that a patent may be granted for that purpose: These are, therefore, to grant, according to law, to the said Lewis Wooster & Joseph E. Holmes, their heirs, administrators, or assigns, for the term of fourteen years from the third day of August, one thousand eight hundred and thirty, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said improvement, a description whereof is given, in the words of the said Wooster & Joseph E. Holmes themselves, in the schedule hereto annexed, and is made a part of these presents.

In testimony whereof I have caused these letters to be made patent, and the seal of the United States to be hereunto affixed.

Given under my hand, at the city of Washington, this third day of August, in the year of our Lord one thousand eight hundred and thirty,

and of the Independence of the United States of America the fifty-fifth.

ANDREW JACKSON.

By the President:
[L. S.]

M. VAN BUREN,
Secretary of State.

CITY OF WASHINGTON, *to wit:*

I do hereby certify that the foregoing letters-patent were delivered to me on the third day of August, in the year of our Lord one thousand eight hundred and thirty, to be examined; that I have examined the same, and find them conformable to law; and I do hereby return the same to the Secretary of State, within fifteen days from the date aforesaid, to wit, on this fourth day of August, in the year aforesaid.

J'N MACPHERSON BERRIEN,
Attorney-General of the United States.

662 The schedule referred to in these letters-patent, and making part of the same, containing a description, in the words of the said Lewis Wooster & Joseph E. Holmes themselves, of their improvement in the mode of making or manufacturing paper for writing, printing, wrapping, and boards, from wood.

To all to whom these presents shall come Lewis Wooster & Joseph E. Holmes, of the county of Crawford, and State of Pennsylvania, send greeting.

Be it known that we, the said Lewis Wooster and Joseph E Holmes, have invented, constructed, made, and applied to use, a new and useful improvement in making or manufacturing paper for writing, printing, wrapping, and boards, from wood; the preparation for which, for making the paper in the common paper-mills, is as follows, viz: The wood is reduced to shavings, of the ordinary jack-plane-shaving *vise*, or bruised so as to be rendered to nearly the same size of the shaving; they are then placed in a cistern, or boiler of sufficient dimensions, and covered with water, which is put to a boiling heat; to every one hundred pounds of the wood (thus reduced) put from 12 to 18 pounds of alkali, either vegetable or mineral, in proportion to its quality for strength. If salts are used they should be reduced before they are placed on the wood in the cistern or boiler with the water; they may, however, be put in with the water and wood upon reduction, but the first mode is found the most preferable. Should lime be used there must be a sufficient quantity in all cases to equal twelve pounds of fine black salts for every one hundred pounds of wood which may be leached upon being placed in the cistern with the wood and water are thrown in in its pure state. One hundred of wood, thus prepared, will, if thus well attended to, make from 5 to 7 reams of paper.

663 In testimony that the above is a true specification of our said improvement as before described, we have hereunto set our hands & seals this 6th day of July, A. D. 1836.

LEWIS WOOSTER.
JOSEPH E. HOLMES.

Witnesses:
DERNO DENCHEM.
THO'S ATKINSON.

664 (Indorsed:) Exhibit 16. Aug't 3d, 1830. Wooster & Holmes' patent. Paper from wood. Filed May 21st, 1867.

665 DEF'TS' EXHIBIT 15.—K. G. W., *Ex'r.*

The U. States Patent-Office to all persons to whom these presents shall come, greeting:

This is to certify, that the annexed is a true copy from the records of this office of the letters-patent granted William Magaw, Feb'y 19th, 1830.

In testimony whereof I, T. C. Theaker, Commissioner of Patents, have caused the seal of the Patent-Office to be hereunto affixed, this thirty-first day of May, in the year of our Lord one thousand eight hundred and sixty-six, and of the Independence of the United States the ninetieth.

[SEAL.] T. C. THEAKER.

666 The United States of America to all to whom these letters-patent shall come:

Whereas William Magaw, a citizen of the United States, hath alleged that he has invented a new and useful improvement in the manufacture of paper from straw, hay, or other vegetable substances, for which letters-patent were granted to said William Magaw, to wit, on the 8th day of March, 1828, & on the 22nd day of May in the same year, which letters-patent being hereby cancelled on account of defective specification, which improvement, he states, has not been known or used before his application; hath made oath that he does verily believe that he is the true inventor or discoverer of the said improvement; hath paid into the Treasury of the United States the sum of thirty dollars, delivered a receipt for the same, and presented a petition to the Secretary of State, signifying a desire of obtaining an exclusive property in the said improvement, and praying that a patent may be granted for that purpose: These are, therefore, to grant, according to law, to the said William Magaw, his heirs, administrators, or assigns, for the term of fourteen years from the eighth day of March, one thousand eight hundred and twenty-eight, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said improvement, a description whereof is given in the words of the said William Magaw himself, in the schedule hereto annexed, and is made a part of these presents.

In testimony whereof, I have caused these letters to be made patent, and the seal of the United States to be hereunto affixed.

Given under my hand, at the city of Washington, this nineteenth day of February, in the year of our Lord one thousand eight hundred and thirty, and of the Independence of the United States of America the fifty-fourth.

ANDREW JACKSON.

By the President:

M. VAN BUREN,

[L. S.] *Secretary of State.*

CITY OF WASHINGTON, *to wit:*

I do hereby certify that the foregoing letters-patent were delivered to me on the nineteenth day of February, in the year of our Lord one thousand eight hundred and thirty, to be examined; that I have examined the same, and find them conformable to law; and I do hereby

return the same to the Secretary of State, within fifteen days from the date aforesaid, to wit, on this twenty-second day of February, in the year aforesaid.

J'N MACPHERSON BERRIEN,
Attorney-General of the United States.

667 The schedule referred to in letters-patent and making part of the same.

Containing a description in the words of the said William Magaw himself, of his improvement in the manufacture of paper from straw, hay, or other vegetable substances, for which letters-patent were granted to William Magnaw, to wit, on the 8th day March, 1828, and on the 22nd day of May in the same year, which letters-patent *being* hereby cancelled on account of defective specifications.

This improvement, or discovery, consists in the use of ley and its salts in preparing straw, hay, or other vegetable substances, for the manufacture of paper in the following manner, viz, to one hundred and twenty pounds of the straw, or hay, take the ley procured from three or four bushels of ashes, or from fifteen or twenty pounds of the salts of ley, according to the quantity, dilute it with a sufficiency of water to boil the straw or hay, which need not be all immersed at the commencement, as it will sink during the process of boiling, boil the materials together until the vegetable matter, or knots, become soft, or pulpy, or steep the materials in the solution several days, until the same effect is produced; draw off the remaining liquid and rinse the materials to cleanse them from any dirt, or sediment, then grind them in the usual way, to be manufactured like rags into paper. The petitioner claims as his exclusive improvement, or discovery, the use of its leys and its salts, and the mode of preparing the materials so as to render them fit for the manufacture of paper.

WILLIAM MAGAW.

Witnesses:
I. S. RIDDLE.
LEON CHAPPOTER.

(Indorsed:) Exhibit 15, Feb. 19, 1830. Wm. Magaw, re-issue. Paper from straw, hay, &c. Filed May 21st, 1867.

668 DEF'TS' EXHIBIT 18.—K. G. W., *Ex'r.*

The U. States Patent-Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the re-issued letters-patent granted John Campbell, June 12th, 1850, No. 171.

In testimony whereof I, T. C. Theaker, Commissioner of Patents, have caused the seal of the Patent-Office to be hereunto affixed this twenty-ninth day of April, in the year of our Lord one thousand eight hundred and sixty-seven, and of the Independence of the United States tha ninety-first.

[SEAL] T. C. THEAKER.

669 No. 171.

The United States of America to all to whom these letters-patent shall come:

Whereas, George Spafford, of Windham, Conn., (deceased,) did, in his life-time, allege that he has invented a new and useful improvement

in the machine for boiling & washing rags for manufacturing paper, (for which letters-patent were granted to him, dated Sept. 2, 1840, in which letters-patent he asssigned his whole right, title, and interest, to John Campbell, of New York, N. Y.; & the said letters having been surrendered by said Campbell, the same have been cancelled and new letters ordered to issue to said Campbell on an amended specification) which he stated had not been known or used before his application; made oath that he was a citizen of the United States; that he did verily believe that he was the original and first inventor or discoverer of the said improvement, and that the same had not, to the best of his knowledge and belief, been previously known or used; & the said Campbell having paid into the Treasury of the United States the sum of fifteen dollars, and presented a petition to the Commissioner of Patents, signifying a desire of obtaining an exclusive property in the said improvement, and praying that a patent may be granted for that purpose:

These are, therefore, to grant, according to law, to the said John Campbell, (assignee as aforesaid,) his heirs, administrators, or assigns, for the term of fourteen years from the said second day of September, one thousand eight hundred and forty, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said improvement, a description whereof is given in the words of the said Spafford in the schedule hereunto annexed, and is made part of these presents.

In testimony whereof I have caused these letters to be made patent, and the seal of the Patent-Office has been hereunto affixed.

Given under my hand at the city of Washington, this eleventh day of June, in the year of our Lord one thousand eight hundred and fifty, and of the Independence of the United States of America the seventy-fourth.

T. EWING,
Secretary of the Interior.

Countersigned and sealed with the seal of the Patent-Office.
[L. S.] THOMAS EWBANK,
Commissioner of Patents.

670 The schedule referred to in these letters-patent and making part of the same.

To all to whom these presents shall come:

Be it known that the following is a full, clear, and exact description of a new and useful process for preparing rags and other materials for making pulp in the manufacture of paper, and of the machinery for carrying the same into effect, invented by the late George Spafford, of Windham, in the State of Connecticut, and for which letters-patent of the United States were granted to him on the 2nd day of September, in the year 1840, the said letters-patent being herewith surrendered for the purpose of having the same invention described and presented in a more full, clear, and exact manner than was done in the original specification, and of having a new patent issued upon the specification so amended.

671 The invention consists in digesting, with an alkaline or other liquid, in a close turning vessel, the rags or other fibrous materials for making paper-pulp, the heat being applied to the exterior of the vessel, or by steam introduced within it, as may be deemed most expedient.

In the accompanying drawing, Figure 1 is a perspective view of a close cylindrical boiler and its appendages, one of its heads being removed to expose its interior. Figure 2 is a view in perspective of the head detached from the boiler; and Figure 3 is a section of the boiler at the line, *x x*, of Figure 1, showing a diaphragm of strong reticulated wire.

The body of the boiler, A A, Figure 1, should be made of iron boiler-plate, or other suitable material, strong enough to resist any internal pressure to which the machine may be subjected, and of any convenient dimensions. One ten feet in length and four feet in diameter will hold as a proper charge about 1,300 pounds of rags, with the appropriate quantity of ley, say about 100 gallons of a solution of potash, soda, or lime, in water. When other materials than rags are to be operated upon, as for example straw, cotton-waste, &c., the proportions of the
672 charge will vary, but these variations can easily be determined by the operator. C C C are man holes in the side of the vessel, of which any suitable number may be made, and through which the charge is introduced and withdrawn.

The heads of the boiler are provided with tubular journals or trun'ions, H, by which the boiler is hung in any suitable frame provided with appropriate bearings. The heads are likewise provided with any convenient number of stop-cocks, G G, for drawing off the liquid from the boiler. The interior of the boiler is divided into several compartments by longitudinal grated partitions, B, which abut at one end against the grated diaphragm, Figure 3, and at the other against the head of the boiler.

The main use of these partitions is to facilitate the operation of washing when the apparatus is occasionally used for that purpose, by dividing the charge into several distinct parts, and in this way rendering the access of water to every part of it more easy and certain.

The grated diaphragm seen in Figure 3, and whose position is represented by the dotted line *x x*, in Figure 1, is likewise designed to facilitate the process of washing by acting as a strainer to retain the
673 charge while a stream of water is passed through it.

Although the operation of washing may be performed within the boiler when it is provided with the grated partitions and diaphragm, yet, as this is a distinct process, it could be effected with greater propriety in a separate vessel; therefore, it would, in most cases, be advisable to omit the partitions and diaphragm in the construction of the boiler, as well *as* to save cost as because the boiler, as a digester, will answer well without these devices.

When this apparatus is to be used, the charge of rags or other material for making the pulp, and the liquid with which it is to be digested, may both be introduced through the same man-hole, or the liquid may be introduced through one of the hollow trun'ions, H; the vessel is then closed, steam is introduced through one or both of the trun'ions to heat the charge, and at the same time the boiler is put in motion by any suitable machinery which will turn it with a proper velocity—that of about five revolutions a minute having been found to produce a good result. The application of heat, and the turning of the vessel,
674 are continued until the materials are properly digested, the time required being easily determined by practice, and varying according to the circumstances of each particular case. After the charge has been properly digested, the steam is shut off, the liquor is drawn off from the boiler either through the stop-cocks or man-holes, and the digested materials are discharged by revolving the boiler with the man-

holes open. It is obvious that the boiler may be varied in its form, and in the manner and position in which it is caused to turn or move, without effecting the principle of the invention; and it is contemplated so to vary its arrangements as circumstances may render expedient. The manner in which the heat required in the process is applied may likewise be varied, as, for example, by surrounding the boiler with a steam-jacket, or by placing it over a furnace.

Previous to the introduction of the above-described process, the materials were digested in a stationary vessel in which the agitation was produced by the boiling alone, which, from the unequal density of the mass, was unequal in different portions of the same vessel; hence
675 this process was defective, even when the best stock was operated upon, and the paper produced from the same charge was not of a uniform quality. When the more ref'actory materials used in the manufacture of paper were subjected to this operation, such for example as straw and cotton-waste, the result was still more defective, as the knotty portions of the straw, and the greasy portions of the cotton-waste, were penetrated with difficulty by the digesting liquid, aided by the slight agitation produced by the boiling alone. The process herein described produces such an agitation by the turning of the boiler, and so effectually intermingles the steam and the digesting liquid with the charge, that the latter is digested in the most equable manner, with great economy of heat and time, and the knotty and greasy portions of the above mentioned ref'actory materials are penetrated thoroughly and acted upon by the digesting liquid and the heat. From the thorough agitation of the charge, no portion of it is liable to be over-heated, or to be unequally effected by the digesting liquid, and hence the average
676 quality of paper produced will be better and more uniform than was possible when the stock was prepared by the old process.

What is claimed is the hereinbefore described process of preparing materials for making pulp in the manufacture of paper, by digesting them in a turning vessel with an alkaline solution or other liquid, the heat being applied to the outside of the vessel, or by steam introduced within it, substantially as herein set forth.

JOHN CAMPBELL,
Assignee of the whole right of the late George Spafford.

Witnesses:
AUGUSTINE SMITH.
JOHN W. WILSON.
EX'D. A. T.

(Here follows diagram marked page 676.)

677 DEF'TS' EXHIBIT 19.—K. G. W., *Ex'r.*

The U. States Patent-Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the files of this office of the file-wrapper and contents, in re letters-patent granted Watt & Burgess, July 18, 1854, No. 11343.

In testimony whereof I, S. C. Theaker, Commissioner of Patents, have caused the seal of the Patent-Office to be hereunto affixed, this ninth day of January, in the year of our Lord one thousand eight hundred and sixty-six, and of the Independence of the United States the ninetieth.

[SEAL.] T. C. THEAKER.

678 *Petition.*

To the Hon. Charles Mason, Commissioner of Patents of the United States of America:

The petition of Charles Watt, of the city of London, in the county of Middlesex and Hugh Burgess, also of the city of London, in the county of Middlesex, and kingdom of Great Britain, subjects of Her Majesty Queen Victoria, respectfully represents:

That your petitioners have invented, made, and applied to use certain improvements in pulping and disintegrating vegetable substances, which, they verily believe, have not been known or used prior to the invention thereof by your petitioners. They therefore pray that letters-patent of the United States may be granted to them therefor, vesting in them and their legal representatives the exclusive right to the same upon the terms and conditions expressed in the act of Congress in that case made and provided, they having paid five hundred dollars into the Treasury of the United States, and *provided* with the other provisions of the said act.

And they further pray that A. B. Stoughton, of Washington City,
679 may be recognized as their agents and attorneys to transact business for them at the United States Patent-Office; to alter and amend their specification as they may deem proper; to receive any moneys which they may be entitled to withdraw from the Treasury, and receipt for the same; to receive and transmit the patent when granted; and to do all other acts and things in the premises which they might do if personally present.

CHARLES WATT.
HUGH BURGESS.

680 *Oath.*

We, Charles Watt, of London, & Hugh Burgess, of London, ss., chemists, on this sixth day of January, 1854, before me, the subscriber, Sir Robert Walter Carden, alderman, personally appeared the within-named Charles Watt and Hugh Burges', and made solemn affirmation that they verily believe themselves to be the original and first inventors of the improvements herein described, and that they do not know or believe that the same were ever before known or used, and that they are subjects of the Queen of Great Britain.

CHARLES WATT.
HUGH BURGESS.

Sworn at the Mansion-house, in the city of London, this sixth day of January, 1854, before me—

ROB. W. CARDEN, *Ald'n.*

Certificate.

CONSULATE OF THE UNITED STATES OF AMERICA, LONDON:

I, George N. Sanders, consul of the United States, do hereby
681 make known and certify to all whom it may concern, that Robert W. Car*ter*, before whom the foregoing affidavit was made, as appears by his signature thereto, is an alderman and a magistrate of the city of London, aforesaid, and that to all acts by him so done, full faith and credit are and ought to be given in judicature and thereout.

In testimony whereof I have hereunto set my hand and affixed the

seal of the consulate of the U. S. aforesaid, this sixth day of January, in the year of our Lord one thousand eight hundred and fifty-four, and in the seventy-eighth year of the Independence of the United States.

[L. S.] GEO. N. SANDERS.

682 To all whom it may concern:

Be it known that we, Charles Watt, of the city of London, in the county of Middlesex, and Hugh Burgess, of the city of London, in the county of Middlesex and kingdom of Great Britain, have invented, made, and applied to use certain improvements in pulping and disintegrating vegetable substances, for which letters-patent have been granted to us by Her Majesty the Queen of Great Britain, bearing date the day of , one thousand eight hundred and .

And we do hereby declare that the following specification (being the same on which letters-patent were granted) is a full, clear, and exact description of the same:

The wood or vegetable substances upon which it is intended to operate by this process, should first be reduced to very fine shavings or cuttings—the finer the better. This may be done in any suitable machine.

The shavings are then to be boiled in a solution of caustic alkali, the strength of which being dependent on the nature of the vegetable
683 substance operated on, can only be learned by experience. For deal or fir wood, we find that a solution of alkali of the strength indicated by 12° of the English hydrometer answers very well. The length of time necessary for this part of the process is somewhat dependent on the nature of the vegetable substance to be treated.

We find boiling in a solution of caustic alkali, under pressure, of considerable service.

We do not claim this operation as a part of our invention.

The shavings are then to be well washed and pressed, and the washings may be saved and evaporated down and burned in a suitable furnace, when they are again available for the same purpose. The damp shavings are now to be exposed to the action of chlorine or the compounds of chlorine with oxygen, till on a portion being placed in a dilute solution of caustic alkali, the vegetable substance falls into a dark pulpy mass.

This part of the process is conveniently effected by placing the
684 damp shavings on racks or drawers about nine inches apart, one above another, arranged in a chamber, and allowing the chlorine or the compounds of chlorine with oxygen, to enter *enter* the chamber and fill it. Of the compounds of chlorine and oxygen we prefer that known as protoxide of chlorine, or hypochlorous, or chlorous acid, or euchlorine.

If found more convenient, the chlorine, or the compounds of chlorine with oxygen, may be used in aqueous solution instead of the gaseous form. As soon as the shavings have been sufficiently acted upon by the gas, as may be ascertained by the method above described, they may be removed, and the hydrochloric acid, which is the result of the above process, removed by washing, and the shavings well pressed. This should be done with as little water as possible, as this acid may be saved and made use of for the reproduction of chlorine.

The shavings are now to be placed in a weak solution of caustic alkali, when they will fall into a pulpy mass of a dark-brown color. This part of the process may be expedited by exposing the mass to the ac-
685 tion of a beater or "engine" placed in the tank containing the solution of alkali.

The pulp obtained as above described, having been freed from the alkali by washing, which may be saved as before directed, may now be bleached by the usual process, or, as we prefer, by chlorite or hypochlorite of soda or potash, liberating the chlorous or hypochlorous acid by hydrochloric acid.

Having thus fully described the nature of our invention, and shown how the same may be reduced to practice, we wish it to be distinctly understood that we do not confine our claim to the apparatus or utensils, or the manipulations herein named, as they may be varied to suit the circumstances of the case; but what we do claim as of our invention, and desire to secure by letters-patent, is the pulping and disintegrating of shavings of wood and other similar vegetable matter, for making paper, by treating them with caustic alkali, chlorine simple, or its compounds with oxygen and alkali, in the order substantially as described.

In witness whereof we have hereunto set our signatures this sixth day of January, in the year one thousand eight hundred and fifty-four, in the presence of two subscribing witnesses.

686 CHARLES WATT.
HUGH BURGESS.

Witnesses:
WILLIAM LEWIS,
8 *St. Albans Terrace, Kennington.*
JOHN WATT,
1 *Ampton street, Gray's Inn road.*

687

688 (Indorsed:) Rec'd & filed Feb. 3, 1854. S. T. Shugert.

689 6 FEB'Y, '54.

Your application for letters-patent for an alleged imp't in making paper is at hand. There, however, being no evidence filed of it that a patent had been granted to you in England, & for the subject of your present application, you are herewith requested to furnish such evidence, if you desire your case to *have* examined at once.

Mess. WATT & BURGESS,
(Care of A. B. Stoug'ton, esq., present.)

690 Filed 11 Feb'y, '54. J. Typawd.

WASHINGTON, *Feb y 11th*, 1854.

Hon. CHA'S MASON,
Comm. of Patents.

SIR: In reply to yours of the 6th inst., in relation to the application of Watt & Burgess for making pulp for paper, I have the honor to enclose you the within affidavit of Mr. Burgess, one of the inventors.

Very resp'y,

A. B. STOUGHTON,
Att'y for Watt & Burgess.

691 PATENT-OFFICE, 16 *Feb.*, '54.

SIR: The specification and claims of your application for alleged improvements in treating fibre for paper-stuff have been duly examined, & it is found that you have not sent any specimens that indicate the stages of the operation. There must be sent, in quantity sufficient for experimenting with, a specimen of the crude fibre, ready to be treated by alkali; a specimen of the fibre, ready to be converted into

brown pulp; a specimen of the brown pulp made by treating the fibre in the way described, and say how long so treated, and whether with chlorine or euchlorine; a specimen of the pulp bleached afterwards with chlorine, and say how bleached, if any peculiarity about it.

The case is postponed till the specimens are received.

Respectfully,

WATT & BURGESS,
(Care of A. B. Stoughton, esq, present.)

692 WASHINGTON, *March 10th*, 1854.

Hon. CHA'S MASON,
Comm'r of Patents.

SIR: Herewith I have the honor to present to the office, in compliance with your instructions of the 16th ulto., specimens of the material in its various stages, in the matter of the application of Watt & Burgess, for making pulp for paper.

No. 1 contains shavings boiled in alkali.

No. 2 is No. 1 treated with chlorine.

No. 3 is No. 2 treated with alkaline lye, forming the pulp.

No. 4 is the pulp bleached.

The bleaching process completes the formation of the pulp; that is to say, any portion which may not be completely pulped by the 3rd process is finished by the 4th.

Very resp'y,

A. B. STOUGHTON,
For Watt & Burgess.

(Indorsed:) Watt & Burgess' letter. Filed 10–3, '54. J. Tyssowski.

693 PATENT-OFFICE, 24 *March*, '54.

SIR: Your specification for a patent for treating wood fibre by alkali & chlorine, or its compounds with oxygen, is herewith returned to you for explanations, as noted on the margin thereof, and for a clear and definite expression of what the novelty in your devices is confined to, both in the specifying of the nature of the invention and in the setting forth of the claim. There are at least forty applications for patents, or patents themselves, on record, for processes of treating vegetable fibre, and in a large part of these alkali and chlorine, or its compounds, are used. Under these circumstances the statement of the nature of invention, the disclaimer, and the claim, do little to distinguish any novelty in the invention. Instead, therefore, of rejecting your claim, as must inevitably be done if decided on in its present form, the papers are given to you for your further action in the case.

Respectfully,

Mess. WATT & BURGESS,
(Care of A. B. Stoughton, esq, present.)

694 DEF'TS' EXHIBIT A.—K. G. W., *Examiner.*

WASHINGTON, *April 7th*, 1854.

Hon, CHA'S MASON,
Comm'r of Patents.

SIR: In compliance with your letter of the 24th ulto, and the pencil notes on the margin of Watt & Burgess' specification for pulping, &c.,

vegetable matter, I would state that their invention relates to a series or combination of processes in the order in which they are stated, for treating shavings, &c., for the purpose of reducing them from their crude state to a pulp, ready to be made into paper. The several processes through which the shavings pass, may be enumerated in the following order, viz:

First. The shavings are boiled in a solution of caustic alkali, until by the test of washing, they have lost their woody taste, (for white pine shavings about 3 hours,) when they are washed and pressed to rid them of the alkali.

Second. They are then subjected to the action of chlorine or its compounds, and oxygen, until by testing a portion in a dilute solution of caustic alkali, it falls into a dark pulpy mass, when it is again washed and pressed to remove the hydrochloric acid, which is the result of this process.

695 Third. The material is then subjected to a weak solution of caustic alkali, when it falls into a pulpy mass of a dark brown color. It is then again washed to free it of the alkali, and may be bleached by any of the known processes.

The shavings must pass through these several processes, and in the order stated, and this constitutes the invention. The processes taken separately will not produce the article, but their sum will, and they are only claimed in their series, and not in their individual capacitys. It is admitted that alkali and chlorine have been used in pulping vegetable matter. But it is not known that alkali, chlorine, oxygen, and alkali, have been used in the manner, and in the order, in which Messrs. Watt & Burgess use them. This order and series of processes is what, therefore, constitutes their invention, and what they suppose they have embodied in their claim; but are willing to meet the views of the office in defining their invention, if they have not already done so, by the description and the present explanations.

696 These processes may be expedited, by additional means, as they have described, but this is a question of economy and not of invention.

Very resp'y,

A. B. STOUGHTON,
For Watt & Burgess.

The specification is herewith returned; the pencil note thereon being answered in the "first" of the series of processes.

Def'ts' Exhibit A., K. G. W., examiner.

(Indorsed:) Argument & amendment filed 7 April, 1854. J. Tyssowski.

697 PATENT-OFFICE, 19 *April*, '54.

SIR: Yours of the 7th instant, explaining somewhat at length that your invention contains nothing novel in the several individual steps of the process, but that it consists in the succession of the steps themselves has been duly considered. In reply you are referred to the following extract from Regnault's Chemistry, vol. 2, p. 447–8. "The substance, (meaning the cellulose or ultimate fibre of wood,) when obtained in as disaggregated form as possible, is digested with hot solutions of caustic potash or soda, and after washing, the residue is treated with weak hydrochloric acid, and washed with water. By repeating this process a certain number of times, the woody fibre may be com-

pletely removed, (that is, from the cellulose or ultimate fibre,) although the same result may be obtained more quickly by subjecting the substance to the more powerful oxidizing re-agents, such as the weak solution of chlorine gas, or hypochlorite of lime, and following each of these treatments by an alkaline solution and dilute hydrochloric acid." This quotation shows that you are anticipated in your invention. The claim is therefore refused.

Respectfully.

Messrs. WATT & BURGESS,
(Care of A. B. Stoughton, esq., present.)

698 Argument filed 10 May, 1854. J. T.
Answered 15 May, '54.

WASHINGTON, *May 10th*, 1854.

Hon. CHA'S MASON,
Comm'r of Patents.

SIR: I have to acknowledge the receipt of the official letter of your office, refusing the claim of Watt & Burgess, for making paper-pulp. With due respect for the opinions of the office, I am obliged to differ with them in the relevancy of the reference given for such rejection.

In "Regnault's chemistry," referred to by the office, is mentioned a scientific fact which if it had been the same essentially as described and claimed by Watt & Burgess, ought not, and could not, under the multitude of decisions by the courts, be adduced as a barrier to the grant of letters patent for an actual bona-fide result. A scientific fact may lie buried in the books for years, and the world be none the wiser of it. It is the actual reduction of that fact to practice—the benefitting of the world at large, by establishing the practicability and feasibility of that fact, that constitutes invention. The world at large might be at this day, totally ignorant of a magnetic telegraph, so far as the books
699 are concerned (although they mentioned the fact that a magnetic current would pass over proper conductors) had not practical invention stepped in and filled up the blank.

But the reference given, is not the same thing claimed by Messrs. Watt & Burgess. And if the office had given the whole of the paragraph referred to, this would be self-evident. The last sentence of the paragraph says as follows: "It is washed, sucessively, with alcohol and ether to dissolve the fatty matter." This of itself is sufficient to defeat the practical use of the process described by Regnault. An article of manufacture or commerce produced thus expensively could not compete with any of the present known methods. Mr. Watt & Burgess, do not use alcohol & ether; if they did, their alleged invention would be useless except as a scientific fact. But by avoiding the use of expensive chemicals, or difficult or uncertain chemical processes, they produce a valuable article at much less prices than has heretofore ever been done. This they can prove to the office, if required.

700 But the difference in the processes described in Regnault, and these claimed by Watt & Burgess are not confined solely to the use and disuse of alcohol and ether. Regnault says, in speaking of the cellulose, that it "is digested with hot solutions of caustic potassa or soda, and after washing, the residue is treated with weak chlorohydric acid and washed with water. By a repetition of this process for a certain number of times, the woody fibre may be completely removed."

Now this repetition of the process is not used by Watt & Burgess at all, and they consequeetly save the expense and time of so doing.

The office may assert that Regnault goes further and says that the process may be quickened by using "more powerful oxydizing re-agents." It is admitted—but even then, "each of these treatments" (must be followed) "with an alkaline solution and dilute chlorohydric acid." Here then is a striking difference between the two processes. But further, Regnault says, "although those various re-agents attack the cellular tissue itself the action is much less active than on the substance surrounding it; so that if the operation be carefully conducted, and re-
701 agents diluted with water be alone used, the greater portion of the cellulose escapes destruction."

Now the office must admit that the whole description of the process in Regnault is a scientific fact only, which might in a laboratory, under skillful hands, produce a pulp, at a cost 500 pr. ct. above the cost of a better, known, article. He says, "the greater portion of the cellulose escapes destruction," under his process. Now a fraction over one-half, will be the greater portion, and such a saving for an article to be manufactured and go into general use, would amount to a total non-use of the article. For all practical purposes, then, the process in Regnault is useless. Messrs. Watt & Burgess produce a pulp equally as good for very many purposes, as rag-pulp, and at a cost of nearly 20 per cent. less than rag-pulp. By their process the shavings are reduced to pulp in 12 hours; and in six hours more it is bleached and ready to be made into paper. Besides, by their process, it is a mere question of time, and not of a carefully conducted operation, and they do not lose any appreciable portion of the cellulose.

702 The office has been very particular (and I do not mention it in the way of censure, for I think it but proper) to require Messrs. Watt & Burgess to state their process in the most exact terms, "How long they boil in alkali;" whether they "regard the oxide as the equivalent of the chlorine;" "How they use it;" "How they prepare it;" "How do you use or prepare the aqueous chlorine?" Is the chloride of lime in solution?" &c. None of these things are stated in Regnault, and yet it is decided to be the same as Watt & Burgess. They show a feasible, practical, and cheap method of producing pulp, and are met by a scientific abstraction, which, at most, will make but a costly experiment.

The claim of Watt & Burgess covers their invention as they understand it, and consists in the use of caustic alkali, chlorine (or its compounds) with oxygen, and alkali, in the order described. There is no such succession of chemical appliances mentioned in Regnault. Nor can such results be produced by the process in Regnault, as Watt & Burgess produce by their simple, certain, and cheap process. They therefore ask a reconsideration of their application at your earliest convenience. The specification is returned.

Very resp'y,

A. B. STOUGHTON,
Att'y for Watt & Burgess.

703 WASHINGTON, *July 18th*, 1854.

Hon. COMM'R OF PATENTS:

Will please forward the patent of Messrs. Watt & Burgess, to the care of F. B. Houghton, esq., No. 4, New street, New York City, and much oblige

Yours, &c.

A. B. STOUGHTON.

704 Application of Watt & Burgess. Imp't in making paper.

The applicant proposes to make paper from woody fibre by treating it in a certain manner.

Chemists had before shown that by treating woody fibre in a manner not widely dissimilar to that pointed out by the applicant, a substance which is termed "cellulose" is obtained. It was also known that cellulose constitutes, in an almost pure state, the substance of which paper has heretofore been made.

Under these circumstances it has been thought that the making of paper in the manner pointed out by the applicant was not patentable.

But it is one thing to ascertain a scientific fact, & it is another and a very different thing to subjugate that fact to the common every day purposes of life. The latter is patentable, the former not.

Can it be possible that a pine plank can be transformed into a ream of paper without including a patentable discovery in the process by which that end is attained? Now, the chemist who merely separates the cellulose from the other ingredients of the wood cannot stop there and obtain a patent for his discovery. In order to claim such a
705 patent he must show some practical benefit that will result from it. The benefits of the patent law are entirely intended for the practical man. The man of science makes the great discoveries which the practical man turns to account. The labors of the former may be far the most meritorious; the latter is the only one for whom a pecuniary recompense is provided.

In the case of making paper from wood, if the present applicant cannot obtain the patent no one can. This of itself would seem a sufficient reason for granting the patent. But, by changing our point of view a little, we shall see the reason of this more clearly.

Science had ascertained that cellulose could be obtained from wood in substance the same as the fibre of flax or cotton. If, now, some one should contrive a means of transforming this cellulose into a substance that could be spun and woven into strong and durable cloth, does any one doubt of the patentability of the discovery? The making of paper would seem almost equally so.

Again the discoveries of the chemist are irrespective of expense.
706 Whether the means used can ever be employed practically in constructing any material from cellulose for common use is wholly unknown so far as anything has been ascertained from him. The pointing out a practicable mode of producing cellulose from wood in a manner requiring so little labor and expense as to cause its adoption in the useful arts involves a patentable discovery.

A patent will therefore be granted.

C. MASON.

(Indorsed:) Decision. Application of Watt & Burgess, improvement in making paper. Affirmative. Filed June 29, 1854. Recorded vol. 1, p. 263.

707 Application of Watt & Burgess. Improvement in making paper from wood.

A patent is allowed in this case for reasons on file.

C. MASON, *Comm'r.*

708 Filed in Febr., 54. J. J. W.

CITY OF NEW YORK, *State of New York, ss:*

Before me, the subscriber, a commissioner of deeds in and for the city of New York, personally appeared Hugh Burgess, who, being duly sworn according to law, deposeth and saith that he, in connection with Charles Watt, did make application for letters-patent of the United States, on the third day of February, 1854, for an improvement in the process of pulping and disintegrating shavings and other similar vegetable substances for making paper. That an application is now before the English patent-office for the same invention in the joint names of the said Watt & Burgess; which application is dated 19th Aug., 1853, and sealed (as appears by the October, 1853, number of the Mechanic's Magazine) on the 27th Oct., 1853. That the invention described and claimed in the specification filed in the U. S. Patent-Office, on the 3rd day of Feb'y, '54, is embodied in the English application aforesaid, and is really and substantially for the same invention. Deponent further states that Mr. Watt, who is a joint inventor with him (deponent) in this application, is not now in the United States.

HUGH BURGESS.

709 Sworn and subscribed before me, this 9th day of February, 1854.

GEO. P. NELSON,
Comm'r of Deeds.

STATE OF NEW YORK,
City & County of New York, ss:

I, Richard B. Connolly, clerk of the city and county of New York, and also clerk of the supreme court for the said city and county, being a court of record, do hereby certify that Geo. P. Nelson, before whom the annexed deposition was taken, was, at the time of taking the same, a commissioner of deeds for said city and county, duly appointed and sworn and authorized to administer oaths, to be used in any court in said State, and for general purposes; and that his signature thereto is genuine, as I verily believe.

In testimony whereof I have hereunto set my hand and affixed the seal of the said court and county the 10th day of February, 1854.

RICH'D B. CONNOLLY, *Clerk.*

710 PATENT-OFFICE, 15 *May*, 1854.

SIR: Your letter of the 10th instant, replying to the official letter rejecting your claim to the process of making paper-pulp, is duly received.

You object to the reference found in Regnault's Chemistry, and denominate it a "scientific abstraction," as though a process published in a book of science is less a publication than it would be if published in a Patent-Office report. The reference is a "printed publication," and although for obvious reasons (namely, that of separating all foreign matters whatever from the pure cellulose by means of alcohol & ether) the process is carried further in the description in Regnault than you may find it profitable to do, still your process, you must admit, is therein embraced. You indicate a want of fairness in the office in not quoting in the reference the use of the alcohol & ether to remove the last portions of fatty matter, which is an extra treatment, only required when cellulose in perfect purity is called for, and which could never be used in connection with the previous treatment of alkalies, chlorine,

and acids. There was, therefore, no necessity and would have been no pertinency in introduing the alcoholic and ethereal treatment in the reference of the office.

711 You complain of the reference because you say you do not repeat the process of digesting the fibre in the chemicals used, while the reference says that by a repetition of the process the woody fibre may be completely removed. Now, the repetition of the process is only necessary where all the woody fibre matter is to be removed, leaving only the celulose. Although you may be satisfied with using the process without repetition, it is still a process and is still a pertinent reference.

The queries made in the official letter might have been made in a separate letter, it is true, but they were inserted here that if there were any facts connected with them not yet developed in the case they might be brought out by these queries, & that would save writing an extra letter. In fine the office does not perceive any justifiable ground for changing its action in this case.

Respectfully,

WATT & BURGESS.
(Care of A. B. Stoughton, esq., present.

712 2798. No. 11343. Watt & Burgess, of , county of , of England.

Imp't in making paper.

Rec'd ..... Feb'y 3, 1854.
Petition ..... " " "
Affidavit ..... " " "
Specification ..... " " "
Drawing } within { ..... " " "
Model } within { ..... " " "
Cert. dep.
1. Cash $5.00 ..... " " "
Examined ..... June 30th, '54, C. M.
2. Issue, Shugert ..... June 30, '54.
4. Patented ..... July 18, 1854.
Recorded vol. 57, page 492.
*Date of English pat ..... 19 Aug., 1853.
P.

A. B. STOUGHTON, *Washington.*

713 Letter ..... 6 Feb'ry, '54.
Letter, must send specimens ..... 16 Feb., '54.
R'v'd spec. to specify ..... 24 Mar., '54.
Rejected ..... 19 April, '54.
Spec. to me ..... April 25, 1854.
A. B. STOUGHTON.

Rejected[2] ..... 15 May, '54.

(Indorsed:) Improvement in the manufacture of paper from wood.

714 (Indorsed:) Exhibit 19. July 18, 1854. Watt & Burgess. Correspond'ce, &c., as to patent. Petition. Oath 5th Jan'y,

1854. Specification corrected. Correspondence. Samples called for. Letter Ap'l 7, 1854, explaining the invention. Correspondence thereon. Decision of the Comm'r. The claim of invention very restricted. Filed May 21, 1867.

715 DEF'TS' EXHIBIT 20.—K. G. W., *Ex'r.*

The U. S ates Patent-Office to all persons to whom these presents shall come greeting:

This is to certify that the annexed is a true copy from the files of this office of the file-wrapper and contents in re letters-patent, granted Ladd & Morris, ass'ees of Houghton ass'ee of Watt & Burgess, July 18, 1854. (Re-issued.) No. 608.

In testimony whereof I, T. C. Theaker, Commissioner of Patents, have caused the seal of the Patent-Office to be hereunto affixed, this sixteenth day of January, in the year of our Lord one thousand eight hundred and sixty-six, and of the Independence of the United States the ninetieth.

[SEAL.] T. C. THEAKER.

716 To the Commissioner of Patents:

The petition of William F. Ladd, of the city, county, and State of New York, and Morris L. Keen, of the city and county of Philadelphia, and State of Pennsylvania, respectfully represents:

That letters-patent of the United States were granted to Charles Watt and Hugh Burgess, of London, England, for "improvement in manufacture of paper from wood," which letters-patent were granted on the 18th day of July, 1854, and antedated to the 19th day of August, 1853; that the said letters-patent were assigned to Frederick B. Houghton, of the city of New York, on or about the 5th day of October, 1854, and all the rights and privileges accruing under them; that the said Frederick B. Houghton did, by deed of conveyance, dated the 1st day of May, 1856, assign to your petitioners all his right, title, and interest for, to, and in said letters-patent; that your petitioners now believe the said patent to be inoperative and invalid by reason of a defective specification, which defect has arisen from inadvertance and mistake. They therefore pray that they may be allowed to surrender the same, and request that new letters-patent may issue to them for the same invention, for the residue of the period for which the original patent was granted, under the amended specification herewith presented, they having paid fifteen dollars into the Treasury of the United States, agreeably to the requirements of the act of Congress in that case made and pro-

717 vided. And they further pray that you will consider A. B. Stoughton, of Washington City, as their attorney, with full authority to act for them in the premises.

W'M F. LADD.
MORRIS L. KEEN.

CITY & COUNTY OF NEW YORK,
State of New York, ss:

On this tenth day of September, A. D. 1858, before the subscriber, a commissioner of deeds, personally appeared the above-named William F. Ladd, and made solemn oath that he verily believes Charles Watt and Hugh Burgess above named to be the original and first inventor of the herein described process for pulping and bleaching wood and other fibrous vegetable substances, and of which invention Morris L.

Keen aforesaid and myself are owners by conveyances as above stated; that he believes that, by reason of a defective or inefficient specification, the aforesaid patent is not fully valid and available to them; and that said error has arisen from inadvertance, accident, or mistake, and without any fraudulent or deceptive intention, to the best of his knowledge or belief.

JA'S MONCRIEF,
Comm'r of Deeds, 29 Wall street, City of New York.

STATE OF NEW YORK,
City and County of New York, ss:

I, Richard B. Connolly, clerk of the city and county of New York, and also clerk of the supreme court for said city and county, do hereby certify that James Moncrief, whose name is subscribed to the certificate of the proof or acknowledgement of the annexed instrument, and thereon written was, at the time of taking such proofe or acknowledgement a commissioner of deeds for said city and county, dwelling in the said city, commissioned and sworn, and duly authorized to take the same. And further, that I am well acquainted with the handwriting of such commissioner, and verily believe that the signature to the said certificate of proof or acknowledgement is genuine.

In testimony whereof I have hereunto set my hand and affixed the seal of the said court and county, the 10 day of Sept., 1858.

[NEW YORK SEAL.] RICHARD B. CONNOLLY, *Clerk.*

COUNTY OF CHESTER,
State of Pennsylvania, ss:

On this thirteenth day of September, A. D. 1858, before the subscriber, a justice of peace, personally appeared the above-named Morris L. Keen, and made solemn oath that he verily believes Charles Watt and Hugh Burgess above named, to be the original and first inventors of the herein-described process for pulping and bleaching wood and other fibrous vegetable substances, and of which invention W'm F. Ladd aforesaid and myself are owners, by conveyances as above stated; that he believes by reason of a defective or inefficient specification, the aforesaid patent is not fully valid and available to them, and that the said error has arisen from inadvertance, accident, or mistake, and without any fraudulent or deceptive intention, to the best of his knowledge or belief.

JOHN MUNSHOWER.

To all whom it may concern:

Be it known that Charles Watt and Hugh Burgess, of London, England, did invent, make, and apply to use certain improvements in pulping and disintegrating vegetable substances for which letters-patent have been granted to them by Her Majesty the Queen of Great Britain, bearing date the 19th of August, 1853, and we do hereby declare that the following is a full, clear, and exact description of said invention, and the mode of carrying out the same:

The wood or vegetable substances upon which it is intended to operate by this process should first be reduced to very fine shavings or cuttings, the finer the better. This may be done in any suitable machine. The shavings or vegetable substances are then to be boiled in a solution of caustic alkali, the strength of which being dependent on the nature of the vegetable substance operated on, can only be learned by experience. By the "nature of vegetable substance" is meant its gummy or resinous nature or its absence from such substance. For deal or fir wood, which contain resinous matter, a solution of alkali of the strength indicated by 12° of the English hydrometer answers very well. The length of time

necessary for this part of the process is somewhat dependent on the nature of the vegetable substance to be treated, that is, its resinous or gummy nature; and bo'ling in a solution of caustic alkali, under pressure, is of considerable importance. By the words "under pressure" is meant a pressure at, near, or above 300 degrees of Fahrenheit's scale, the ordinary pressure used by us, being from 300 to 500 degrees, in accordance with the nature of substance to be treated.

The shavings or vegetable substances being pulped are then to be well pressed and washed, the pressings and washings may be saved and evaporated down and burned in a furnace suitably constructed,
721 when they are again available for same purpose. The damp mass of materials being pulped are now to be exposed to the action of chlorine, or the compounds of chlorine with oxygen, and can then be made into white paper if the materials used was not of a highly resinous nature. If the material under treatment was of highly resinous character it should then be washed and placed in a dilute solution of caustic alkali, warm preferred, the vegetable substance then falls into a dark pulpy mass, and when washed can be bleached by any desirable method known. Good white pulps will be obtained by the above processes, according to the resinous or non-resinous properties of materials under treatment, and the pulps will retain their clear appe'rance for any length of time in their pulpy state, or after they are made into paper. The above described gasing or bleaching process is conveniently effected by placing the damp shavings, vegetable substance, or pulpy mass on racks or drawers about nine inches apart, one above another, arranged in a chamber and allowing the chlorine or the compounds of chlorine with oxygen to enter the chamber and fill it. Of the compounds of chlorine with oxygen we prefer that known as *eo*toxide of chlorine or hypochlorous or chlorous acid or euchlorine. If found more convenient the chlorine or the compounds of chlorine with oxygen may be used in aqueous solution instead of the gaseous form. As soon as the shavings, vegetable substance, or pulpy mass have been sufficiently acted upon, the time required
722 being as to their resinous or non-resinous properties, they may be removed, and the hydrochloric acid, which is the result of the above process, removed by washing and well pressing the materials under process. This should be done with as little water as possible, as the acid may be saved and made use of for the re-production of chlorine. When the pulp obtained by the above-described process has been freed from its alkali by pressing and washing, (which pressings and washings liquor may be saved as before described,) it may be bleached by the usual process, or as we prefer, by the chlorite or hypochlorite of soda or potash, [11] liberating the chlorous or hypochlorous acid by hy[12]drochloric acid.

[13] Having thus fully described the invention of said [14] Watt & Burgess, what we claim as of their invention, and desire to [15] secure by letters-patent, is the pulping or disintegrating of [16] *shavings of wood and other similar vegetable matter for making paper* [vegetable substances] in the manner substantially as [17] herein described, according to the nature of the vegetable [18] substance to be treated.

W'M F. LADD.
MORRIS L. KEEN.

Witnesses to sig. of W'm F. Ladd—
JAS. MONCRIEF, 29 *Wall st., N. Y.*
GEORGE W WILLIS, 25 *Wall st.*
Witnesses to signature of Morris L. Keen—
W. D. EVANS.
EPHRAIM MILLER.

(Indorsed:) Rec'd & filed Sept. 14, 1858. J. F. G.

723 Messrs. LADD & KEEN.
(Care A. B. Stoughton, Washington, D. C.)

U. S. P. O., *Sept.* 21, 1858.

GENT'N: Your appl'n for re-issue of letters-patent granted to Watt & Burgess, for imp'ts in treatment of vegetable substances for paper-pulp is herewith returned for amendment by confining the claim to "shavings of wood and other similar matters" as in original patent. A claim to the pulpying vegetable substances broadly was not contemplated in the original appl'n.

Respectfully,

(Indorsed:) Office to Ladd & Keen. Sept. 22, '58.

724 COUNTY OF CHESTER,
State of Pennsylvania, ss:

Before the subscriber a justice of peace, personally appeared Hugh Burgess, who, being duly sworn according to law, deposeth and saith, that he is the Hugh Burgess, who, in connection with Charles Watt, were the inventors and patentees of an "improvement in the manufacture of paper from wood," which was patented to them in England, on the 19th day of August, 1853, and in the United States, on the 18th day of July, 1854; that this deponent for himself, and as the attorney of Charles Watt, did assign to Frederick B. Houghton, then of New York City, all the right, title, and interest for, to, and in said patent, to said Houghton; that he verily believes that the said Houghton had and did possess the whole right to said patent, when he assigned it to W'm F. Ladd and Morris L. Keen, and that the said Ladd & Keen are now the owners of the entire patent; that he believes the said Houghton is not in the United States, but that he resides in Europe, and that he has no knowledge of where the deed of conveyance, which he made for himself, and as attorney of Charles Watt, is, but is informed that it is lost or mislaid.

HUGH BURGESS.

Sworn and subscribed before me, this thirteenth day of September.
JOHN MUNSHOWER.

(Indorsed:) Rec'd & filed Sept. 14, '58. J. F. G.

725 WASHINGTON, *Sept. 22d*, 1858.

Hon. J. HOLT, *Comm'r of Patents.*

SIR: Yours of the 21st returning the application of Ladd & Keen's re-issue for amendment of the claim, is received. I have to request that the subjoined amendments may be made thereto. Specif. herewith returned.

Resp't'y,

A. B. STOUGHTON, *Att'y.*

Amend the spec'f. of Ladd & Keen, assignees of Watt & Burgess for a re-issue as follows:

Page 4, line 16, after the word "of" erase the words "vegetable substances," and substitute therefor the words "shavings of wood and other similar vegetable matter for making paper."

A. B. STOUGHTON.

22D SEPT., '58.

(Indorsed:) Rec'd & filed Sept. 22, '58. Amendment.

726 *568] Re-issue. [* *

No. 608. W'm F. Ladd & Morris L. Keen, assignees of Fred'k B. Houghton, assignee of Charles Watt & Hugh Burgess.

Of New York, &c.
County of "
State of "

Manuf. of paper from wood.

Rec'd ..... Sept. 14, 1858.
Petition ..... " " "
Affidavit ..... " " "
Specification ..... " " "
Drawing
Copy old patent.
Cert. dep.
1. Cash, $15 ..... Sept. 14, '58.
Examined Thos. Antisell ..... Sept. 21, '58.
2. Issue H. McCormick ..... Sept. 24, 1858.
4. Patented ..... July 18, 1854. +
Pat. in Eng ..... Aug. 19, 1853, re-issued Oct. 5, 1858. +
Recorded, vol. 6, page 1.
Ex'd. A. T.
P.

A. B. STOUGHTON,
Wash., D. C.

1 Spec'n ret. to amend. claim, Sept. 21, '58.

(Indorsed:) "Improvement in manufacture of paper from wood."

(Indorsed:) Exhibit 20. Re-issue of Watt & Burgess, patent of 1854. 10 Sept'r, 1858. Petition & oath. Specification with amendment. Confining patent to "shavings of wood & other similar vegetable matter." Filed May 21st, 1867.

727 DEF'TS' EXHIBITS 21.—K. G. W., *Ex'r.*

The U. States Patent-Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the files of this office of the file-wrapper and contents in re letters-patent granted M. L. Keen, Sep. 13, 1859, No. 25418.

In testimony whereof I, T. C. Theaker, Commissioner of Patents, have caused the seal of the Patent-Office to be hereunto affixed, this ninth day of January, in the year of our Lord one thousand eight hundred and sixty-six, and of the Independence of the United States the ninetieth.

[SEAL.] T. C. THEAKER.

728 *Petition.*

To the Commissioner of Patents:

The petition of Morris L. Keen, of Royer's Ford, in the county of Montgomery and State of Pennsylvania, respectfully represents, that your

petitioner has invented a new and useful improvement in boilers for boiling wood or ligneous materials for making paper-pulp under pressure, which he verily believes has not been known or used prior to the invention thereof, by your petitioner; he therefore prays that letters-patent of the United States may be granted to him therefor, vesting in him and his legal representatives the exclusive right to the same, upon the terms and conditions expressed in the act of Congress in that case made and provided, he having paid thirty dollars into the Treasury, and complied with other provisions of the said act.

He further prays that you will recognize as his agent and attorney A. B. Stoughton, whom he hereby authorizes and empowers to alter and modify the within specification and claim; to receive the patent when granted; to receive back any money which he may be entitled to withdraw from the Treasury, and to receipt for the same; and in general to demand and exercise all the rights and privileges that he would be entitled to if personally present and acting in the premises.

MORRIS L. KEEN.

Oath.

COUNTY OF CHESTER, *State of Pennsylvania, ss:*

729 On this fourth day of June, A. D. 1859, before the subscriber, a justice of the peace in and for said county, personally appeared the within-named Morris L. Keen, and made solemn oath that he verily believes himself to be the original and first inventor of the within described imp't in boilers for boiling wood or ligneous materials, and that he does not know or believe that the same was ever before known or used; and that he is a citizen of the United States.

LEVI RALSTON, *Justice Peace.*

730 To all whom it may concern:

Be it known that I, Morris L. Keen, of Royer's Ford, in the county of Montgomery, and State of Pennsylvania, have invented certain new and useful improvements in boilers for boiling wood or ligneous materials for making paper-pulp under pressure; and I do hereby declare that the following is a full, clear and exact description of the construction and operation of the same, reference being had to the accompanying drawings, in which—

Fig. 1 represents a perspective view of said boiler.

Fig. 2 represents a vertical central section through the same.

My invention relates to the construction of a boiler for boiling wood and ligneous materials for making paper-pulp, in which proper provision is made for keeping the stock covered by the alkali or liquid used, and giving it motion to insure the mass being properly boiled throughout, and a discharge-valve or cock, by means of which the stock, when sufficiently boiled, is blown out in a pulpy state.

To enable others skilled in the art to make and use my invention, I will proceed to describe its construction and operation:

A represents a vertical cylindrical boiler, which is mounted on supports B, or on any other suitable frame. The upper part of the boiler is made conical, and is provided with an expansion-chamber, C, through the aperture of which the boiler is charged, and which is closed by a cover, D, which is bolted steam-tight to the same. The bottom of the boiler A is made funnel shaped, and ends in the center in the discharge-pipe E, which is closed by a piston or stop-cock, G; the latter is secured

to the rod H, and can be opened or closed by means of the hand-
731 wheel F of the rod H, which passes through the stuffing-box I, and has its lower bearing in the bracket *a*. K represents two stirrers, the shafts of which run at their lower ends in the steps *b*, while their upper ends pass through the stuffing-boxes L, and are provided with pinions M, which are driven by suitable gearing. The shafts of the stirrers K, are provided on one side only with the horizontal stirring-arms, which, when the boiler is to be charged, are turned towards the periphery of the boiler, and are therefore not in the way of the material as it is thrown into the boiler. *d* represents a perforated plate, which is secured to the rod N, and which rests on the brackets *g*, of the expansion chamber C; it is intended to press the material down, and to keep it submerged in the fluid in which it is to be boiled; the plate *d*, is prevented from rising by the upper end of the rod N being in contact with the lower face of the cover, D. O represents try-cocks, by which the material in the boiler can be tried to what degree of perfection the stock is worked.

The operation is as follows:

The boiler being charged with the proper solution of caustic alkali, or other suitable fluid, and with the material which is to be reduced to pulp, the plate *d* is placed upon it, and the cover D is screwed down tightly. The boiler A is then heated, either by a direct fire or by any other heating apparatus, and the mass in the boiler is boiled and stirred until thoroughly disintegrated. During this process the steam arising from the fluid rises through the perforated plate *d*, and fills the expansion-chamber C, whence it exerts a pressure upon the boiling mass in the boiler.

When the stock has been reduced to the desired perfection, the
732 stop-cock G is opened by means of the hand-wheel F, and the entire mass is blown by the pressure of the steam in the expansion-chamber and boiler, through the pipe E, as a pulp, into an open tank adjacent to the boiler A. The expansion-chamber C may be provided with a pipe leading to a steam-gauge to indicate the pressure of steam in the boiler.

[10] Having thus described my invention, what I claim is a [11] boiler for boiling, under pressure, wood and ligneous ma[12]terials for making paper-pulp, constructed with an expansion [13] chamber, specifically for the purpose set forth, and substantially [14] as described.

[15] I also claim the specific construction of stirrers for
Erase & insert A. Filed Aug. 5, '59. purpose [16] substantially as described.

[17] I also claim the discharge valve or cock for the specific [18] purpose set forth, substantially as described.

MORRIS L. KEEN.

[19] Witnesses:
[20] EPHRAIM MILLER,
[21] HUGH BURGESS.

(Indorsed:) Filed June 7, 1859. J. F. G.

733 U. S. PATENT-OFFICE, *June 29th*, 1859.

SIR: The second and third claims of your application for patent for improved boiler for making paper-pulp do not present anything new. A stirrer of the same construction, substantially, is common. See hominy-machines and coffee-roasters. The discharge valve or cock has the same function only, in your machine, as in others in which it is used. It is not patentable to apply it to a particular purpose. It is possible

that a claim founded on the arrangement of parts presented by your machine could be allowed.

The specification is herewith enclosed for your further consideration.

MORIS L. KEEN,
(Care A. B. Stoughton, esq.)
Washington City, D. C.

25
4
100

R. D. C.

(Indorsed:) Keen. Sp'f. ret'd June 29, '59.

734 WASHINGTON, *Aug. 5th*, 1859.

Hon. COMM'R of PATENTS:

SIR: In accordance with your suggestion of the 29th June, in relation to the application of Morris L. Keen for a paper-pulp boiler, I have to request that the subjoined amendment may be made to the specif'n, which, together with the drawing is herewith returned.

Resp't'y.

A. B. STOUGHTON, *Att'y for Keen.*

Amend Morris L. Keen's spec'f. as follows:

On page 3 erase all after the word "chamber" in the 13th to the end of the 18th line, and insert in lieu thereof as follows: "*stirre's, and discharge valve or cock arranged for the purposes, and in the manner, substantially as herein stated.*"

A—insert.

A. B. STOUGHTON.

5TH AUG., '59.

(Indorsed:) Keen. Amendment A. Filed Aug. 5, '59. Ef.

735 266, 116–16. No. 25418. Morris L. Keen, of Roger's Ford' county of Montgomery, State of Pennnsylvania.

Boiler for boiling wood, &c., for making paper-pulp.

Rec'd	June 7, 1859
Petition	" " "
Affidavit	" " "
Specification	" " "
2 drawing	" " "
Model	" " "
Cert. dep.	" " "
1. Cash, $30	June 7, 1859
Examined (R. D. Clarke)	Aug't 29th, '59
2. Issue, Shugert	Aug. 30, 1859
4. Patented	Sept. 13, 1859

Recorded vol. 104, page 478.
B

A. B. STOUGHTON, *W., D. C.*

Lett—specif'n ret'd for am't ..... June 29th 1859

(Indorsed:) Impovement in boilers for making paper-pulp from woods.

(Indorsed:) Exhibit 21. Sep'r 13, 1859. M. L. Keen's boiler, with expansion-chamber, stirrers, & discharge-valve. Petition. Oath. Spec-

cification corrected. Correspondence requiring it to be confined to "the arrangement." Filed May 21st, 1867.

736 DEF'TS' EXHIBIT 22.—K. G. W., *Ex'r.*

The U. States Patent-Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the files of this office, of the file-wrapper and contents in re letters-patent (re-issued) granted Ladd & Keen, ass'ees of Watt & Burgess, April 7th, 1863. No. 1846.

In testimony whereof I, T. C. Theaker, Commissioner of Patents, have caused the seal of the Patent-Office to be hereunto affixed, this thirteenth day of January, in the year of our Lord one thousand eight hundred and sixty-six, and of the Independence of the United States the ninetieth.

[SEAL.] T. C. THEAKER.

737 The petition of William F. Ladd, of the city, county, and State of New York, and Morris L. Keen, of the city and county of Philadelphia, and State of Pennsylvania, respectfully represents:

That letters-patent of the United States were granted to Charles Watt and Hugh Burgess, of London, England, for "Improvement in manufacture of paper from wood," which letters-patent were granted on the 18th day of July, 1854, and ante-dated to the 19th day of August, 1853; that said letters-patent were surrendered and re-issued on the 5th day of October, 1858, to your petitioners; that the original letters-patent were assigned to Frederick B. Houghton, of the city of New York, on or about the 5th day of October, 1854, with all the rights and privileges accruing under said patent; that the said Frederick B. Houghton did, by deed of conveyance, dated the 1st day of May, 1856, assign to your petitioners all his right, title, and interest for, to, and in the United States; that your petitioners now believe that the said re-issued patent is inoperative and invalid by reason of a defective specification, which defect has arisen from inadvertence and mistake. They therefore pray that they may be allowed to surrender the same, and request that two new letters-patent may issue to them, for the same invention, for the residue of the period for which the original patent was granted, under the amended specifications herewith presented, they having paid sixty dollars into the Treasury of the United States, agreeably to the requirements of the act of Congress in that case made and provided.

WILLIAM F. LADD.
MORRIS L. KEEN.

738 COUNTY OF PHILADELPHIA, *State of Pennsylvania:*

On this 17th day of March, 1863, before the subscriber, an alderman, personally appeared the above-named Morris L. Keen, and made solemn oath that he verily believes that, by reason of an insufficient or defective specification, the aforesaid patent is not fully valid and available to them, and that said error has arisen from inadvertence, accident, or mistake, and without any fraudulent or deceptive intention, to the best of his knowledge or belief.

MORRIS L. KEEN.

Sworn & subscribed before me this seventeenth day of March, A. D. 1863.

WILLIAM S. OGLE,
Alderman, Ex-officio Justice of the Peace.

739 COUNTY OF WESTCHESTER, *State of New York:*

On this 18th day of March, 1863, before the subscriber, a justice of the peace, personally appeared the above-named W'm F. Ladd, and made solemn oath that he verily believes that, by reason of an insufficient or defective specification his aforesaid patent is not fully valid and available to him; and that said error has arisen through inadvertence, accident, or mistake, and without any fraudulent or deceptive intention, to the best of his knowledge and belief.

W'M F. LADD.

Sworn and subscribed before me this eighteenth day of March, A. D. 1863.

ELIAS ALAMN,
Justice of the Peace.

740 To all whom it may concern:

Be it known that Charles Watt and Hugh Burgess, of London, England, did invent a new and useful improvement in the manufacture of paper-pulp from wood and other vegetable substance, and that the following is a full, clear, and exact description thereof.

The wood or vegetable substance, from which it is intended to make the pulp, should first be reduced to fine shavings or cuttings. This may be done in any suitable machine.

The shavings or cuttings of wood, or the vegetable substances, are then to be boiled in a solution of caustic a'kali, in a suitable boiler, under pressure. The strength of the alkali is dependent on the nature of the vegetable substance used and operated upon. For non-resinous woods a solution of alkali of the strength indicated by 17° of the English hydrometer, or thereabouts, answers very well, and for deal, pine, or fir wood, or other woods containing resinous matter, a strength of about 12° is sufficient, but varying, with the nature of the vegetable substance being acted upon, to a strength of about 10° degrees. The varied nature of the vegetable substance to be operated upon is such that only general directions can be given for the strength of the alkali, or the degree of heat to be used, or the duration of the operation. Boiling in a solution of caustic alkali, under pressure, is of essential importance. By the words "under pressure" is meant, a pressure at,
741 near, or above 300 degrees of Fahrenheit's scale, which is the ordinary pressure used; but a heat and corresponding pressure of from 300 to 500 degrees may be used, according to the nature of the vegetable substance to be treated, whether resinous or non-resinous, or otherwise, and the time may be from four to twelve hours, according to the nature of the substance.

After the vegetable substance has been thus operated upon, by caustic alkali, under heat and pressure, for the requisite time as above described, it should be discharged from the boiler, while under pressure, into a tank or other reservoir with proper safety valves and pipes, for the discharge of the steam, and should be drawn as soon as the steam shall have escaped, into open vats, where it can be operated upon in the next stage of the process, or it may be drawn directly into the vats from the boiler.

The vats which receive the wood-shavings or cuttings, or other vege-

table substances being formed into pulp, should be constructed with suitable means of drainage. The alkaline solutions must then be removed from the pulp, either by percolation and subsequent washing in the vats, or by pressure, in any convenient apparatus and subsequent washing. The mode of percolation has generally been found sufficient. The alkaline solutions thus obtained may be saved and evaporated down, and the residuum burned in a furnace suitably constructed
742 so as to prepare the alkaline substances for use in a repetition of the same process.

The alkaline solutions having been removed by percolation and washing, or by pressure and washing, the wet mass of woody or vegetable pulp is now to be exposed to the action of chlorine or the compounds of chlorine with oxygen, for the purpose of bleaching it and preparing it for the manufacture of white paper. Brown, colored, or unbleached paper of a good quality can be produced from the pulp as soon as the alkaline solutions are removed, but for the production of good white paper it is necessary to subject the pulp to the bleaching process. If the material used be wood or vegetable substance of a non-resinous nature, the pulp may be bleached by subjecting it to the action of chlorine in a gaseous form, or, which is *is* preferable in this case, in an aqueous solution, in any of the common and well-known modes.

If the wood or vegetable substance be of a resinous nature, the alkaline solutions should be removed by the mode above described, and the pulpy mass should be exposed to the action of chlorine or its compounds with oxygen. This may be done by placing the pulpy mass of woody or vegetable substance on racks or drawers arranged in a chamber, and applying chlorine or its compounds with oxygen in the gaseous form, which, with resinous substances, is preferable to the aqueous solution, until the mass is sufficiently acted upon. The mass must then be again
743 well washed and treated with a weak solution of caustic alkali, warm preferred, which changes the red color to a dark brown. The alkaline solution should then be removed by washing, and the resulting grey pulp may be bleached by any ordinary method of bleaching.

What we claim in this patent as the invention of Charles Watt and Hugh Burgess, as a new article of manufacture, is a pulp suitable for the manufacture of paper, made from wood or other vegetable substances, by boiling the wood or other vegetable substance in an alkali under pressure, substantially as described.

WILLIAM F. LADD.
MORRIS L. KEEN.

Witnesses to W. F. Ladd—
JONATHAN S. ODELL.
SAMUEL COLES.
Witnesses to M. L. Keen—
GEO. C. WARD.
PATRICK WARD.

(Indorsed:) Rec'd & filed, March 23, '63. E. E.

744 (Official business.)

UNITED STATES PATENT-OFFICE,
March 23*rd*, '63.

The examiner will please take up immediately the app'n of Watt & Burgess, assignors for re-issue.

Improvement in manufacture of paper.

JOHN L. HAYES.

745 1846. Re-issue A.

No. 1448. William F. Ladd (1,) and Morris L. Keen (2,) assignees, by mesne ass'ts of Cha's Watt and Hugh Burgess.

Of	New York (1.)	Philadelphia (2.)
County of	" "	"
State of	" "	Penn.

Manufacture of paper from wood.

Rec'd	March 23rd, 1863		
Petition	"	"	"
Affidavit	"	"	"
Specification	"	"	"
Drawing	"	"	"
Old pat.	"	23rd,	"

Cert. dep.
1. Cash, $30 ..... March 23rd, 1863
Add'l fee cert.
" " cash.
Examined B. S. Hedrick ..... March 25th, '63
2. Issue, Hayes ..... March 27th, 1863
4. Patented ..... July 18, 1854+
Re-issue ..... October 5, 1853, antedated Aug. 19, '53
Re-re-issue ..... April 7, 1863
Recorded vol. No. 11. page 257.
Circular.
Ex'd. A. T. A. B. STOUGHTON,
P. *Present.*

Ret'd ..... Mar. 24, 1863

(Indorsed:) Improved pulp from wood, &c., for the manufacture of paper.

(Indorsed:) Exhibit 22. Re-issue of Watt & Burgess patent of 1854. Petition, 17th March, 1863. Amended specification. No correspondence. (See correspondence on the other division of the re-issue.) Filed May 21st, 1867.

746 DEF'TS' EXHIBIT 23.—K. G. W., *Ex'r.*

The U. States Patent-Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the files of this office of the file-wrapper and contents in re re-issued letters-patent granted Ladd and Keen, ass'ees of Watt & Burgess, Ap'l 7th, 1863, No. 1847.

In testimony whereof I, T. C. Theaker, Commissioner of Patents, have caused the seal of the Patent-Office to be hereunto affixed this thirteenth day of January, in the year of our Lord one thousand eight hundred and sixty-six, and of the Independence of the United States the ninetieth.

[SEAL.] T. C. THEAKER.

747 The petition of William F. Ladd, of the city, county, and State of New York, and Morris L. Keen, of the city & county of Philadelphia, and State of Pennsylvania, respectfully represents:

That letters-patent of the United States were granted to Charles Watt and Hugh Burgess, of London, England, for "Improvement in manufacture of paper from wood," which letters-patent were granted on the 18th day of July, 1854, and antedated to the 19th day of August, 1853; that said letters-patent were surrendered, and re-issued on the 5th day of October, 1858, to your petitioners; that the original letters-patent were assigned to Frederick B. Houghton, of the city of New York, on or about the 5th day of October, 1854, with all the rights and privileges accruing under said patent; that the said Frederick B. Houghton did, by deed of conveyance, dated the 1st day of May, 1856, assign to your petitioners all his right, title, and interest for, to, and in the United States; that your petitioners now believe that the said re-issued patent is inoperative and invalid by reason of a defective specification, which defect has arisen from inadvertence and mistake:

They, therefore, pray that they may be allowed to surrender the same, and request that two new letters-patent may issue to them, for the same invention, for the residue of the period for which the original patent was granted, under the amended specifications herewith presented, they having paid sixty dollars into the Treasury of the
748 United States, agreeably to the requirements of the act of Congress in that case made and provided.

And they further pray that you will regard A. B. Stoughton, of Washington City, as their attorney in the matter.

WILLIAM F. LADD.
MORRIS L. KEEN.

[1 dollar, 1. W. F. L., 18 Mar., '63. M. L. K., Mar. 17th, 1863. 1 dollar, 1.]

COUNTY OF PHILADELPHIA,
State of Pennsylvania:

On this 17th day of March, 1863, before the subscriber, an alderman, personally appeared the above-named Morris L. Keen, and made solemn oath that he verily believes that, by reason of an insufficient or defective specification, their aforesaid patent is not fully valid and available to them, and that said error has arisen through inadvertence, accident, or mistake, and without any fraudulent or deceptive intention, to the best of my knowledge and belief.

MORRIS L. KEEN.

Sworn and subscribed before me, this seventeenth day of March, A. D. 1863.

WILLIAMS OGLE,
Alderman, Ex-officio Justice of the Peace.

749 COUNTY OF WESTCHESTER,
State of New York:

On this 18th day of March, 1863, before the subscriber, a justice of the peace, personally appeared the above-named W'm F. Ladd, and made solemn oath that he verily believes that, by reason of an insufficient or defective specification, his aforesaid patent is not fully valid and available to him, and that said error has arisen through inadvertence, accident, or mistake, and without any fraudulent or deceptive intention, to the best of his knowledge and belief.

WILLIAM F. LADD.

Sworn & subscribed before me, this eighteenth day of March, A. D. 1863.

ELIAS A. CARME,
Justice of the Peace.

750 To all whom it may concern:

Be it known that Charles Watt and Hugh Burgess, of London, England, did invent, make, and apply to use certain improvements in pulping and disintegrating wood and other vegetable substance, for which letters-patent were granted to them by Her Majesty the Queen of Great Britain, bearing date the 19th of August, 1853; and we do hereby declare that the following is a full, clear, and exact description of said invention, and of the mode of carrying out the same in practise:

The wood or vegetable substances, upon which it is intended to operate by this process, should first be reduced to fine shavings or cuttings. This may be done in any suitable machine.

The shavings or cuttings of wood, or the vegetable substances, are then to be boiled in a solution of caustic alkali, in a suitable boiler, under pressure. The strength of the alkali is dependent on the nature of the vegetable substance used and operated upon. For non-resinous woods a solution of alkali of the strength indicated by 17° of the English hydrometer, or thereabouts, answers very well; and for deal, pine, or fir wood, or other woods containing resinous matter, a strength of about 12° is sufficient, but varying with the nature of the vegetable substance being acted upon to a strength of about 10°. The varied

751 nature of the vegetable substance to be operated upon is such, that only general directions can be given for the strength of the alkali, or the degree of heat to be used, or the duration of the operation.

Boiling in a solution of caustic alkali, under pressure, is of essential importance. By the words "under pressure" is meant a pressure at, near, or above 300 degrees of Fahrenheit's scale, which is the ordinary pressure used; but a heat and corresponding pressure of from 300 to 500 degrees may be used, according to the nature of the vegetable substance to be treated, whether resinous or non-resinous, or otherwise, and the time may be from four to twelve hours, according to the nature of the substance. After the vegetable substance has been thus operated upon by caustic alkali, under heat and pressure, for the requisite time as above described, it should be discharged from the boiler, while under pressure, into a tank or other reservoir, with proper safety-valves and pipes for the discharge of the steam, and should be drawn as soon as the steam shall have escaped into open vats, where it can be operated upon in the next stage of the process, or it may be drawn directly into the vats from the boiler.

The vats which receive the wood shavings or cuttings, or other vegetable substances being formed into pulp, should be constructed with suitable means of drainage. The alkaline solutions must then be removed from the pulp, either by percolation and subsequent washing in

752 the vats, or by pressure in any convenient apparatus, and subsequent washing. The mode by percolation has generally been found sufficient.

The alkaline solutions thus obtained may be saved and evaporated down, and the residuum burned in a furnace suitably constructed, so as to prepare the alkaline substances for use in a repetition of the same process.

The alkaline solutions having been removed by percolation and washing, or by pressure and washing, the wet mass of woody or vegetable pulp is now to be exposed to the action of chlorine, or the compounds of chlorine with oxygen, for the purpose of bleaching it and preparing it for the manufacture of white paper. Brown, colored, or unbleached paper of a good quality can be produced from the pulp as soon as the

alkaline solutions are removed; but for the production of good white paper, it is necessary to subject the pulp to the bleaching process. If the material used be wood or vegetable substance of a non-resinous nature, the pulp may be bleached by subjecting it to the action of chlorine in a gaseous form, or, which is preferable in this case, in an aqueous solution in any of the common and well-known modes. If the wood or vegetable substance be of a resinous nature, the alkaline solutions should be removed by the mode above described, and the pulpy mass should be exposed to the action of chlorine, or its compounds with oxygen. This may be done by placing the pulpy mass of woody or vegetable substance on racks or drawers arranged in a chamber, and applying chlorine or its compounds with oxygen, in the gaseous
753 form which, with resinous substances, is preferable to the aqueous solution, until the mass is sufficiently acted upon. The mass must then be again well washed and treated with a weak solution of caustic alkali, (warm preferred,) which changes the red color to a dark brown. The alkaline solution should then be removed by washing, and the resulting grey pulp may be bleached by any ordinary method of bleaching.

What we claim as the invention of Charles Watt and Hugh Burgess is, first, the process of treating wood or other vegetable substance by boiling in an alkali, under pressure, as a process or preparatory process for making pulp for the manufacture of paper from such woods or other vegetable substances, substantially as described. We also claim the process of treating resinous woods by boiling in an alkali under pressure, and treating the product with chlorine and its compounds, with oxygen, for making white pulp for the manufacture of paper from such woods, substantially as described.

WILLIAM F. LADD.

Witnesses to W. F. Ladd—
JONATHAN S. ODELL.
SAMUEL COLES.

MORRIS L. KEEN.

Witnesses to M. L. Keen—
GEO. C. WARD.
PATRICK WARD.

(Indorsed:) Rec. & filed March 23, '63. E. E.

754 24] U. S. P. O., *Mar.* 24, '63.

SIR: In the matter of your application for re-issue in two divisions of your patent for improvement in the manufacture of paper-stock from wood, your attention is called to the French patent of Moinier-Legoux, March 12, 1839, Brevets d'Invention, tom. 52, p. 413; also the French patent of Montgolfier frères, Feb. 7, 1838, Brevets d'Invention, tom. 67, p. 15. In these patents you will find alkaline liquids, under pressure, used to disintegrate wood and other substances. The mode of bleaching is also very similar to yours.

If there is any difference between your process and that of these French patents you should point it out.

Respectfully,

HEDRICK.

Messrs. LADD & KEEN, [4
(Care A. B. Stoughton, esq.,)
Washington, D. C.

(Indorsed:) Office to Ladd & Keen, Mar. 24, '63.

755 WASHINGTON, *March* 24, 1863.

Hon. D. *T.* HOLLOWAY,
Com'r Patents.

SIR: In reference to your letter of this day's date pointing out the apparent similarity of Montgolfier frères, patent of Febr'y 7, 1838, & also Moinier Legoux patent of March 12, 1839, to that desired to be amended by us, we would state that the process's as therein described are essentially different to that adopted by us.

In the production of paper-pulp by our process we do not use any of the modes adopted by Montgolfier frères' for the production of a partial pulp previous to the alkaline treatment under pressure. Montgolfier frères first rasps down the wood, (& from the figures of the machinery it is evident that this preliminary pulping must have been very thorough,) second they soak in lime-water for some hours & then regrind making three processes. From the following well-known facts relative to the manufacture of paper, it is very evident that the Montgolfier frères did not produce a pulp adapted to the sucessful manufacture of paper by
756 the action of alkaline solutions under pressure. In the production of a pulp fit for the manufacture of paper, it is absolutely necessary that the fibre be in such state that it can felt well on the paper machine & for this purpose it must be free from the presence of ligneous or intersticial matter; it must in fact be pure cellulose, in order that it may, by the operation of the rag-engine, be converted into fibre capable of felting. No raw woody fibre can be converted into good paper, from the impossibility of giving it the felting properties by the rag-engine. We find from long experience that all vegetable substances have a definite amount of pure cellulose or fibre, & this averages from 30 to 40 p. cent., & consequently the loss in ligneores or intersticial matter to be about 70 to 60 p. cent.

In our mode of manufacture we produce in about four hours, by the manner described in our patent a pulp perfect in every respect for the manufacture of the best classes of paper. This pulp may at once be run into paper, or if desired to be bleached, can be bleached with less difficulty & cost than ordinary rag-pulp or half-stuff.

From the following facts, it is evident that Montgolfier frères did not produce a pulp fit for the practical application of paper-making by their compound process of preliminary pulping & subsequent treatment in alkaline solutions, under pressure.

757 They state that the loss of interstitial matter is only 30 p'r cent. (p. 17) or in other words that they get 70 p'r cent. fibre, a proof that pure cellulose was not obtained. They also mention that when it is desired to make a brown paper from the unbleached pulp it is necessary to reprecipitate the resin removed by boiling by means of a metallic salt or by alum. It is obvious they had not produced a felting fibre, but merely a disintegrated mass of impure cellulose, that required a cementing or sizing of the fibres together & to which no action of the rag-engine could impart the necessary felting properties. A further proof that they did not produce a pure fibre is evident from the fact that they state that chloride of lime or chlorine will not bleach the pulp (p. 22) produced by their process. It should be noticed that when Montgolfier frères desire to bleach their pulp they adopt such means as would produce pure cellulose or a perfect pulping while only bleaching was the object sought. The use of chlorine & caustic alkali at the same time would, as is well known completely disintegrate woody matter, & is used for that purpose for the production of pulp from vegetable substances. Montgolfier frères therefore complete their disintegrating pro-

cess by chlorine & hence they do not find it necessary to cement the fibres together as in the unbleached pulp.

758 From the above facts it is evident that Montgolfier frères only used the boiling in alkaline solutions, under pressure, as part of their compound process. It is further evident they did not use the pressure we declare to be necessary in our patent, as they state neither chlorine nor chloride of lime will bleach their pulp tho' it has been subjected to alkaline solution, under pressure, whereas we are able to bleach with chloride of lime at less cost than the ordinary half-stuff or rag-pulp.

In regard to Legoux' patent, boiling under pressure is named, but not in connection with alkaline solution. As we claim the production of a perfect pulp by the sole action of alkaline solutions, under a given pressure, we do not think the compound & imperfect process described by Montgolfier frères affects our patent. We believe we are the first who used an alkaline solution, under the necessary pressure to insure the desired temperature, as a sole means of producing a perfect pulp suitable to the successful manufacture of paper.

In regard to bleaching, the two processes are, we think, essentially different, in that we make use of chlorine & alkali only for the purpose of bleaching pulp from resinous woods; &, moreover, we use chlorine in a gaseous form & then treat with dilute alkali, whereas Montgolfier use the two in solution, under pressure, at the same time.

Yours, respectf',

LADD & KEEN.
p. H. BURGESS.

(Indorsed:) Rec'd & filed March 24, '63. Explanatory letter from applicant.

759 1847. Re-issue div. B.

No. 1449. William F. Ladd (1,) and Morris L. Keen (2,) assig'ees, by mesne ass't of Cha's Watt and Hugh Burgess.

Of	New York (1.)	Philadelphia (2.)
County of	" "	"
State of	" "	Penn.

Manufacture of paper from wood.

Rec'd	March 23d, 1863
Petition	" " "
Affidavit	" " "
Specification	" " "
Drawing	
Old pat. with A	" " "
Cert. dep.	
1. Cash, $30	March 23rd, 1863
Add'l fee cert.	
" " cash.	
Examined B. S. Hedrick	Mar. 25, '63
2. Issue, Hays	March 27, 1863
4. Patented	July 18, 1854 ×
Re-issue	Oct. 5, 1858, antedated Aug. 19, '53
Re-reissue	Ap'l 7, '63

Recorded vol. No. 11, page 259.
Circular.
Ex'd. A. T.
P.

A. B. STOUGHTON, *Present.*

(Indorsed) Reto. Mar. 24, '63. Exhibit 23. Improved process of treating wood or other vegetable substances in the manufacture of paper-pulp. 17th March, 1863. Petition of Ladd & Keen with proposed re-issue in two divisions. Correspondence. Exam'r refers to French patents. Reply explaining limited extent of the claim. Filed May 21st, 1867.

760 (DEFENDANTS' EXHIBIT No. 24.—R. E. STILWELL, *Examiner, &c.*

The U. States Patent-Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the records of this office, of the letters-patent granted Lemuel W. Wright, March 27th, 1847, No. 5041.

In testimony whereof I, T. C. Theaker, Commissioner of Patents, have caused the seal of the Patent-Office to be affixed, this thirtieth day of April, in the year of our Lord one thousand eight hundred and sixty-seven, and of the Independence of the United States the ninety-first.

[SEAL.] T. C. THEAKER.

761 No. 5041.

The United States of America to all to whom these letters-patent shall come:

Whereas Lemuel W. Wright, (residing in London, England,) has alleged that he has invented a new and useful improvement in making paper, which he states has not been known or used before his application; has made oath that he is a citizen of the United States; that he does verily believe that he is the original and first inventor or discoverer of the said improvement, and that the same hath not, to the best of his knowledge and belief, been previously known or used; has paid into the Treasury of the United States the sum of thirty dollars, and presented a petition to the Commissioner of Patents, signifying a desire of obtaining an exclusive property in the said improvement, and praying that a patent may be granted for that purpose:

These are, therefore, to grant, according to law, to the said Lemuel W. Wright, his heirs, administrators, or assigns, for the term of fourteen years from the twenty-seventh day of March, one thousand eight hundred and forty-seven, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said improvement, a description whereof is given in the words of the said Lemuel W. Wright, in the schedule hereunto annexed, and is made part of these presents.

In testimony whereof I have caused these letters to be made patent, and the seal of the Patent-Office has been hereunto affixed.

Given under my hand, at the city of Washington, this twenty-seventh day of March, in the year of our Lord one thousand eight hundred and forty-seven, and of the Independence of the United States of America the seventy-first.

JAMES BUCHANAN,
Secretary of State.

Countersigned and sealed with the seal of the Patent-Office.

[L. S.] EDMUND BURKE,
Commissioner of Patents.

762 The schedule referred to in these letters-patent, and making part of the same.

These improvements consist—

Firstly, in the novel arrangement and construction of the several parts of the machinery or apparatus employed, and in the application of the same to the process of reducing and bleaching straw and other fibrous substances (such as wheat, oat, barley, rye, or rice straw, wood, and jute-weed, commonly called surat, as well as various kinds of grass, and Indian-corn leaves or husks, &c., to be used for the manufacture of various kinds of paper, mill-board, card-board, button-board, &c.

Secondly, in the particular machinery or apparatus for washing and cleaning, all the dirty and extrane'us matter from the straw or other fibrous substances.

Thirdly, in the peculiar adap'tion of the machinery or apparatus used or employed for reducing or grinding the same into a state of
763 pulp by means of heavy rollers revolving on a plate as hereinafter described.

Fourthly, in the continuation of the washing of the fibrous substance in the pulpy state, and in the peculiar apparatus or machinery, employed for the purpose of boiling the same by steam.

And fifthly, in the machinery or apparatus for washing the pulp from the boiling process, for performing the souring and chloride processes and thus perfecting the operation of bleaching the pulp ready for use as hereinafter described.

In order that the present improvements may be fully described and shewn in detail, I have represented in the accompanying drawings my improved machinery or apparatus for bleaching and preparing the straw or other fibrous substances as hereinafter described. The figures in sheet I, are drawn upon a scale of about one-quarter of an inch to the foot.

Description of the drawings in sheet I, Fig 1, is a longitudinal
764 elevation of the bleaching and pulping apparatus, drawn mostly in section to show the working of the process more clearly; and Fig 2, is a plan view of the same, in which I have shown a set of the apparatus arranged.

Similar letters of reference are marked upon corresponding parts of the machinery or apparatus in both the figures.

The tub or vessel A, is for the purpose of mixing lime and water together commonly called solution of lime or "milk of lime." *b* is a pipe and cock for admitting water.

Steam is admitted into the bottom of this tub A by a circular-pipe, *a*, as seen by dotted lines in plan view for the purpose of boiling this solution which is to be admitted as required by the pipe *c* into the boilers or kiers B B, which must be filled half full of straw or other material, previously cut in a chaff-engine about an inch long.

The remaining space in the vessel or kier must be nearly filled with lime-water or milk of lime. An agitator may if required be adapted to the vessel A, in the manner shown in vessels C, E, G, and H. The boil-
765 ing vessels B B, and F F, are made of wrought or cast-iron, and are intended to contain the straw or other material, which is to be boiled with the lime-liquor previously prepared. The said vessels are to be covered with lids and made steam-tight, with safety-valves, and the boiling process should continue about 12 hours. *d* are the circular steam-pipes for boiling the contents of the vessels B B. *e e* are the pipes for admitting water previously heated in the two auxiliary vessels *j* and *f*,

(Indorsed) Reto. Mar. 24, '63. Exhibit 23. Improved process of treating wood or other vegetable substances in the manufacture of paper-pulp. 17th March, 1863. Petition of Ladd & Keen with proposed re-issue in two divisions. Correspondence. Exam'r refers to French patents. Reply explaining limited extent of the claim. Filed May 21st, 1867.

760 (DEFENDANTS' EXHIBIT No. 24.—R. E. STILWELL, *Examiner, &c.*

The U. States Patent-Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the records of this office, of the letters-patent granted Lemuel W. Wright, March 27th, 1847, No. 5041.

In testimony whereof I, T. C. Theaker, Commissioner of Patents, have caused the seal of the Patent-Office to be affixed, this thirtieth day of April, in the year of our Lord one thousand eight hundred and sixty-seven, and of the Independence of the United States the ninety-first.

[SEAL.] T. C. THEAKER.

761 No. 5041.

The United States of America to all to whom these letters-patent shall come:

Whereas Lemuel W. Wright, (residing in London, England,) has alleged that he has invented a new and useful improvement in making paper, which he states has not been known or used before his application; has made oath that he is a citizen of the United States; that he does verily believe that he is the original and first inventor or discoverer of the said improvement, and that the same hath not, to the best of his knowledge and belief, been previously known or used; has paid into the Treasury of the United States the sum of thirty dollars, and presented a petition to the Commissioner of Patents, signifying a desire of obtaining an exclusive property in the said improvement, and praying that a patent may be granted for that purpose:

These are, therefore, to grant, according to law, to the said Lemuel W. Wright, his heirs, administrators, or assigns, for the term of fourteen years from the twenty-seventh day of March, one thousand eight hundred and forty-seven, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said improvement, a description whereof is given in the words of the said Lemuel W. Wright, in the schedule hereunto annexed, and is made part of these presents.

In testimony whereof I have caused these letters to be made patent, and the seal of the Patent-Office has been hereunto affixed.

Given under my hand, at the city of Washington, this twenty-seventh day of March, in the year of our Lord one thousand eight hundred and forty-seven, and of the Independence of the United States of America the seventy-first.

JAMES BUCHANAN,
Secretary of State.

Countersigned and sealed with the seal of the Patent-Office.

[L. S.] EDMUND BURKE,
Commissioner of Patents.

762 The schedule referred to in these letters-patent, and making part of the same.

These improvements consist—

Firstly, in the novel arrangement and construction of the several parts of the machinery or apparatus employed, and in the application of the same to the process of reducing and bleaching straw and other fibrous substances (such as wheat, oat, barley, rye, or rice straw, wood, and jute-weed, commonly called surat, as well as various kinds of grass, and Indian-corn leaves or husks, &c., to be used for the manufacture of various kinds of paper, mill-board, card-board, button-board, &c.

Secondly, in the particular machinery or apparatus for washing and cleaning, all the dirty and extrane'us matter from the straw or other fibrous substances.

Thirdly, in the peculiar adap'tion of the machinery or apparatus used or employed for reducing or grinding the same into a state of
763 pulp by means of heavy rollers revolving on a plate as hereinafter described.

Fourthly, in the continuation of the washing of the fibrous substance in the pulpy state, and in the peculiar apparatus or machinery, employed for the purpose of boiling the same by steam.

And fifthly, in the machinery or apparatus for washing the pulp from the boiling process, for performing the souring and chloride processes and thus perfecting the operation of bleaching the pulp ready for use as hereinafter described.

In order that the present improvements may be fully described and shewn in detail, I have represented in the accompanying drawings my improved machinery or apparatus for bleaching and preparing the straw or other fibrous substances as hereinafter described. The figures in sheet I, are drawn upon a scale of about one-quarter of an inch to the foot.

Description of the drawings in sheet I, Fig 1, is a longitudinal
764 elevation of the bleaching and pulping apparatus, drawn mostly in section to show the working of the process more clearly; and Fig 2, is a plan view of the same, in which I have shown a set of the apparatus arranged.

Similar letters of reference are marked upon corresponding parts of the machinery or apparatus in both the figures.

The tub or vessel A, is for the purpose of mixing lime and water together commonly called solution of lime or "milk of lime." *b* is a pipe and cock for admitting water.

Steam is admitted into the bottom of this tub A by a circular-pipe, *a*, as seen by dotted lines in plan view for the purpose of boiling this solution which is to be admitted as required by the pipe *c* into the boilers or kiers B B, which must be filled half full of straw or other material, previously cut in a chaff-engine about an inch long.

The remaining space in the vessel or kier must be nearly filled with lime-water or milk of lime. An agitator may if required be adapted to the vessel A, in the manner shown in vessels C, E, G, and H. The boil-
765 ing vessels B B, and F F, are made of wrought or cast-iron, and are intended to contain the straw or other material, which is to be boiled with the lime-liquor previously prepared. The said vessels are to be covered with lids and made steam-tight, with safety-valves, and the boiling process should continue about 12 hours. *d* are the circular steam-pipes for boiling the contents of the vessels B B. *e e* are the pipes for admitting water previously heated in the two auxiliary vessels *j* and *f*,

which is to be used for washing the fibre between the lime processes when repeated.

The pipes *e* e** are for the admission of cold water, if required, into the vessels or kiers B B, and *h h* are the pipes and valves for drawing off the straw or fibrous material and liquor into the washing-tub C when sufficiently boiled.

The tub C is for the purpose of washing the lime and coloring-matter from the straw or fibrous material, and is provided with a false bottom covered with wire-gauze or cloth of about No. 12 mesh, (in order
766 that the fibre may be retained in the tub,) when the water is drawn off by the pipe *i*, and it is also furnished with an agitator which is kept in continued motion, by means of its driving gear, drum, and strap *k k*, which will prevent the wire-cloth from being choked or filled up by the lime-powder as well as to keep the whole mass in action during the washing process.

Water is admitted as required by the pipe *l*, and drawn off by the pipe *i*. After being well washed and cleansed the straw or fibrous material has to be removed from this vessel and submitted to the grinding machine or pulping apparatus D D. Each machine or apparatus D D is composed of two large cast-iron rollers *m m m m*, of about five feet diameter and about five tons weight each.

The surfaces of these rollers must be correctly turned and they revolve on a stationary axle, *n n n n*, properly secured in the frame-work, and bearing or rolling by friction of con*duch* upon the bottom circular iron plate bed or trough, *o o o o*, which must also be turned to
767 fit the surfaces of the rollers. This bed-plate is caused to revolve by means of the bev*ill*ed teeth cast or fixed in segments upon the under sides. The pinion and shaft *p p* gears into and drives the teeth on the bottom of the plate which is supplied with water as required by the pipe *q q*.

The boiled straw or fibrous material from the tub C, is now to be thrown into this trough or bed *o o o o*, and under the rollers, to which it is conducted by guides *s* s* s* s**, and is allowed to remain under the grinding action of the rollers about 15 minutes, more or less, as the nature of the material may require, until the pulping process is completed, when the pulp may be taken out from under the rollers and placed in the tub E, which is of the same construction and used for a repetition of the same purpose as the tub C, with this exception only that the wire-cloth constituting the false bottom of this tub must be of a finer texture, that is, about No. 60, mesh, and made of wire-cloth.

The pipe and tap *r* from this tub are intended for drawing off
778* the waste water with the coloring-matter that passes from the pulp during the process of washing the pipe S, at the same time admitting pure water after this second washing. The pulp is to be passed through the pipes and cocks *t t*, into the close iron vessel or kiers F F, wherein it is to be boiled again for about 6 hours in the lime-water, as afore described, mixed with an alkaline solution of specific gravity of 2° to 4° Baumé's hydrometer for salts, according to the nature of the material to be bleached.

The kiers F F have steam-tight covers, safety-valves, and man-holes. *u* is the circular pipe as before described in vessels A and B B, admitting steam for boiling, and *v v*, water-pipes for admitting water into the kiers.

When the pulp has thus been boiled for 6 hours the steam must be shut off from the circular pipe *u*, and introduced above the liquor by

* Error in paging the original.

the steam-pipes *w w*, which will bring the pressure of the steam upon the top of the pulp and when the cock *x* is opened in the bottom
779 pipe *y*, the pulp and liquor will be forced up the pipe *z*, and discharged into the tubes G G, where it is to be washed again, and in the way before described excepting in this case the false bottom of the tubs are covered with sheet lead, perforated with small holes to retain the pulp and let the water through.

The pulp now being in the tubs G G must, in this stage, *must* be well washed and agitated with water constantly running in at the pipes 1 1, and drawn off as required at the pipe 2. When sufficiently agitated in this vessel the pulp must be submitted to the action for two hours, more or less, (still kept in motion,) of a solution of sulphuric, muriatic, or other acids of the ordinary strength used for bleaching purposes, then washed as before until the acid is all removed from the pulp when it is to be returned through the pipes 3, *z*, *y*, and *x*, into the close kiers F F, when it must be boiled again in a solution of alkali of about 2° to 4°
780 hydrometer which should be continued for about 4 hours or until the strength of the alkali is spent, when the pulp and alkaline-liquor is forced back into the tub G again, and washed as before described.

The washing being completed the pulp is to be agitated in a solution of chloride of lime or bleaching liquor (of the ordinary bleaching strength) for about 2 hours and then the solution is to be brought to the boiling point by the admission of steam through a pipe, *j*, into the tub and kept *it* to that point until the chloride or bleaching liquor is entirely spent; the pulp and liquor is to be let down through the pipe and valve (4) into the tub H, when the washing process must again be performed therein, and when the chloride or bleaching liquor is all washed out it is must be submitted to a process called souring, consisting of a solution of acid and water, of the usual strength for bleaching; and after being agitated therein for about 4 hours, the whole is to be
781 let off through the pipes and valves 5 5 into the tubs I I below where it may remain until the next batch is ready for "souring." The false bottoms of the tubs H and I are covered with perforated lead similar to tub G G. The souring-liquor is to be pumped up the pipe 6, into a tub above to be ready for use again as required. The pipe 7 is for a supply of fresh water when wanted, and the pipes 8 and 9, are for drawing off the "souring" liquor when spent and of no further use.

After the working of the whole of this improved bleaching machinery or apparatus as above described the straw pulp or other fibrous material will be perfectly bleached and fit for the subsequent manufacture of white paper, but I would here remark, that when the pulp is intended to be used for making brown, paper-mill board, &c., the preparing process may be discontinued after the first boiling of the pulp, in the close kiers F F, prior to its being carried into the tubs C C.

And also, that after the pulping and bleaching processes have been completed as above described, the pulp may be submitted to the ordinary rag-engine, for an hour or so, for the purpose of washing,
782 blueing, and clearing the stuff prior to its introduction to the paper-machine.

Fig. 3, sheet 2, represents the machine or apparatus for making mill-board paper which consists of a water-tight box, *a a a*, shown in section, with one end or side *b*, lower than the other three sides. Upon the bottom of this box are two or more supports or rests *c c*. *d d* represent a four-sided frame or pulp-box, having fitted upon its bottom an ordinary laid or woven wire-mould, *e*. The outer box *a a a* is filled with water to

the top of the overflow or waste side *b*. The pulp-box *d d* must then be lowered into the box *a a a* upon the rests or supports *c c*, which will cause the water in the box *a a a* to pass through the mould *e* until it fills the pulp-box *d d* to the level of this water-box *a a a*.

The pulp-box *d d* must be of a depth of proportionate to the thickness of the paper or mill-board required, and the mould *e*, may be attached to the bottom of the box *d d*, by means of small hooks or by any other convenient means.

The figures in sheet 2, are drawn on a scale of about three inches
783 to the foot. The apparatus is now ready for making paper or mill-board, which is to be performed by first having the pulp prepared in a fluid state to a proper consistency. A quantity of this pulp, according to the thickness of the paper or mill-board required, is now to be poured into the pulp-box *d d*, in such a manner as to diffuse itself equally through the mass of water contained within the pulp-box *d d*.

Immediately after pouring in the pulp as before described the pulp-box *d d*, is to be raised perpendicularly out of the water, by which the water will pass through the mould *e*, and leave the pulp deposited therein in a fit state for laying upon the felts, the frame *d d* having been previously removed from the mould *e* for that purpose, in the manner usually adopted by hand mould paper-makers.

Now whereas it is obvious, that this my invention above set forth may be varied in detail according to circumstances, I desire it to be understood that I do not claim the employment of any of the parts of the machinery or apparatus separately, but I do claim as my invention the combination and arrangement of the respective parts of the
784 apparatus as described, by which the straw or other material is subjected in succession to the boiling, washing, and bleaching processes, the respective vessels, the tubes for the conveyance of water and steam, and for the transference of the material, and the apparatus for reducing it to pulp being arranged and operating substantially as herein set forth, by which means the complete preparation of the paper-pulp is effected more economically than heretofore.

I likewise claim the construction of the apparatus for converting the pulp into paper or mill-board; said apparatus consisting of a water-tight box, and of a deep frame, the movable bottom of which constitutes the paper-mould, said box frame and mould being in the arrangement of its parts, and in its operation, such as is herein described and represented.

In witness whereof I, the said Lemuel Wellman Wright, have hereunto set my hand this first day of November, one thousand eight hundred and forty-four.

LEMUEL W. WRIGHT.

Witnesses:
J. W. MOFFATT.
FRED. WALKDEN.
Clerks to Newton & Son.

Ex'd. A. T.

(Here follow 2 diagrams marked page 784.)

785 In the circuit court of the United States for the eastern district of New York.

THE AMERICAN WOOD-PAPER COMPANY
vs.
THE FIBRE-DISINTEGRATING COMPANY. } In equity.

It is hereby stipulated and agreed that the original patent to Azel S.

man, dated 3 August, 1858, No. 21077 now on file amongst the exhibits in this case, may be taken from the file by the defendants, they substituting an official copy thereof from the records of the Patent-office.

FRANCIS C. NYE,
Sol. for Compl'ts.
GEO. GIFFORD,
Sol'r for Def's.

(Indorsed:) Circuit court U. S. E. D. of N. Y. The Amer. Wood-Paper Co. v. The Fibre Dis. Co. Consent to take original patent to A. S. Lyman off the file.

786 The U. States Patent-Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the records of this office, of the letters-patent granted Azel Storrs Lyman, dated 3d August, 1858, No. 21077.

In testimony whereof I, Elisha Foote, Commissioner of Patents, have caused the seal of the Patent-Office to be hereunto affixed, this seventeenth day of April, in the year of our Lord one thousand eight hundred and sixty-nine and of the Independence of the United States the ninety-third.

[SEAL.] ELISHA FOOTE.

787 No. 21077.

The United States of America to all to whom these letters-patent shall come:

Whereas Azel Storrs Lyman, of New York, N. Y., has alleged that he has invented a new and useful improvement in separating the fibre of wood, which, he states, has not been known or used before his application; has made oath that he is a citizen of the United States; that he does verily believe that he is the original and first inventor or discoverer of the said improvement; and that the same hath not, to the best of his knowledge and belief, been previously known or used; has paid into the Treasury of the United States the sum of thirty dollars, and presented a petition to the Commissioner of Patents, signifying a desire of obtaining an exclusive property in the said improvement, and praying that a patent may be granted for that purpose:

These are, therefore, to grant, according to law, to the said Azel Storrs Lyman, his heirs, administrators, or assigns, for the term of fourteen years from the third day of August, one thousand eight hundred and fifty-eight, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said improvement, a description whereof is given in the words of the said Azel Storrs Lyman in the schedule hereunto annexed, and is made part of these presents.

In testimony whereof I have caused these letters to be made patent, and the seal of the Patent-Office has been hereunto affixed.

Given under my hand, at the city of Washington, this third day of August, in the year of our Lord one thousand eight hundred and fifty-eight, and of the Independence of the United States of America the eighty-third.

JACOB THOMPSON,
Secretary of the Interior.

Countersigned and sealed with the seal of the Patent-Office.

[L. S.] J. HOLT,

Commissioner of Patents.

788 The schedule referred to in these letters-patent and making p[art] of the same.

To all whom it may concern:

Be it known that I, A. S. Lyman, of the city, county, and State New York, have invented a new and improved mode of effecting th[e] separation of the fibres of wood for the manufacture of paper, and of flax, and other fibrous substances for the manufacture of cloth, and for other purposes; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon:

It is well known that the fibres of most kinds of wood are arranged in the form of very minute tubes in which the sap circulates.

My improved method of separating these fibres consists in placing the wood or other fibrous material in a strong cylinder or box in
789 which it is subjected to the action of hot water, steam, compressed air, or other fluid, under pressure, for the purpose of charging its tubes, and then causing it to be suddenly projected from the said cylinder or receptacle into the atmosphere, or into a partial vacuum, where each of the tubes is, by the expansive force acting within it, burst open, and the whole of the mass converted into fibre.

The accompanying drawing, which forms part of this specification, exhibits a longitudinal central section of a cylinder, or, as from its operation, it may be termed a gun, for effecting the separation of fibres. This gun may be of any suitable length and calibre, but I consider, for practical purposes, it will be convenient to have it about seven inches diameter internally, and from twenty to twenty-five feet long, as it may then be made by taking a piece or pieces of lap-welded iron-tubing, and permanently closing one end. The other end is fitted with a movable head or cap, B, which is fitted to it after the fashion of a valve, with a suitable packing for making a steam-tight joint, and in order to
790 provide for securing this cap-valve B firmly in its place, to close the gun, I attach to one side of the gun by a rigid arm and hinge-joint, D, a strong lever, C, which is capable of being brought to a position across the cap B, and secured in that position by a hook, E, at one end of the lever H, which is attached to the gun on its opposite side by the hinge-joint *i*. The other end of the lever E has hinged to it a prop-piece, K, which is employed to rest upon the side of the gun, for the purpose of securing the hook E upon the lever C. S is a screw working in the lever C, for the purpose of securing the cap closely to the mouth or muzzle of the gun, and *m* is one of the screw-bolts which attach the cap loosely to the lever *e*. Several of these bolts fastened firmly in the valve B, and sliding in the lever C, are used for the purpose of retaining the cap B, at the time of the explosion. This gun is to be placed in a slightly-inclined position so that a small quantity of water shall settle near the breech-end. It should be mounted in a very strong frame to sustain it against recoil. I prefer to have the wood or
791 other fibrous substance saturated with water before it is put into the gun. When put in, the lever C is brought up and secured by bringing down the hook E of the lever H upon it, and setting up the prop-piece K. Then the strong screw S is driven in to close the cap B tightly. Next, we expel the air by opening a small valve not

shown, and letting in the steam by another small tube not shown, but near the opposite end of the gun from the air-escape valve. When the air is expelled, close the air-valve, and open the valve in another small tube, connecting the boiler and gun so that the water that condenses in the gun may run back down into the boiler. If large sticks of wood are in the gun, the steam must be admitted, for some minutes, to heat them through. If hemp, flax, or straw is to be separated, less time is required in the steam.

I have found a pressure of one hundred and eighty lbs. per inch is about right for separating pine for paper, but a much less pressure will answer for flax or straw.

792 When the heat has sufficiently penetrated the fibrous substance to be exploded, the cap B may be set free, which is done by removing the prop-piece K, when, if the angle on the hook E is properly made, the pressure of the steam in the cylinder-gun will raise the end E of the lever H, and drive off the cap B, and free that end of the gun. The small quantity of hot water at the breech of the gun now drives out the contents of the gun into the atmosphere. As it emerges from the gun, being freed from outside pressure, the sudden conversion of a portion of the water in its tubes or fibres into steam of high tension bursts and separates these fibres.

It is evident that the apparatus employed in the performance of my invention, and the mode of performing it, may be modified considerably without departing from the principle thereof. For instance, instead of using a separate boiler to supply steam to the gun, the steam may be generated, and the water heated in the gun itself by placing therein a quantity of water, and applying the necessary heat to the exterior of the gun.

793 Again, before subjecting the fibrous substance to the action of water or steam, the air may be extracted from it by means of an air-pump. It is also evident that, instead of water, alcohol, or other liquid, or any elastic gas may be used. The invention may also be applicable to the separation of the fibres of other than vegetable substances, and for a variety of purposes.

CLAIM.—What I claim as new and desire to secure, by letters-patent, is the mode of separating the fibres of wood, flax, or other fibrous substances, for paper, cloth, or other purposes, by charging the mass with hot water, steam, compressed air, or other elastic fluid, while in a cylinder, or other suitable receptacle, and then causing it to be projected from said receptacle into the atmosphere or any space where it is subjected to a sufficiently less pressure to cause its disruption by the sudden expansion of the fluid within it, substantially as above specified.

AZEL STORRS LYMAN.

Witnesses—
EDM. F. BROWN.
G. T. AT LEE.

R. W. G.

(Here follows diagram marked page 793.)

794 EXHIBIT No. 26.—R. E. S., *Examiner.*

The U. States Patent-Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from a printed volume in the library of this office, entitled "Central-Blatt für deutsche Papierfabrikation." 2. Band, p. 449.

In testimony whereof I, T. C. Theaker, Commissioner of Patents, have caused the seal of the Patent-Office to be hereunto affixed, this second day of August, in the year of our Lord one thousand eight hundred and sixty-six, and of the Independence of the United States the ninety-first.

[SEAL.] T. C. THEAKER.

795 Central-Blatt für deutsche Papierfabrikation. Herausgegeben von Alwin Rudel. * * * II. Band, 3. und 4. Jahrgang, 1852–53. Nr. 25 bis 42, * * * Halle, * * * 1853. No. 27. * * * Halle, * * * 15. September 1852, p. 449.

III. MITTHEILUNGEN.

Notiz über die Papierfabrikation aus Baumwollabfall (cotton waste) und Stroh in England.*

Da über die Fabrication des Papieres aus Baumwollabfall noch nichts Genaueres in die Öffentlichkeit gekommen sein dürfte, weil die Fabrikanten von Lancashire damit sehr geheimnissvoll sind, so läszt hier der Berichterstatter eine kurze Beschreibung der in den Papierfabriken von Manchester üblichen Methoden und Vorrichtungen folgen, wie er sie dort in den Jahren 1845 und 1846 genau kennen zu lernen Gelegenheit hatte. Im Königreich Sachsen, so wie in der Umgegend von Wien, würde sich jetzt schon eine praktische Benutzung von dem Baumwoll-
abfall für die Papierfabrikation machen lassen, indem dort die
796 Spinnereien dichter zusammen liegen.

Der Baumwollabfall zerfällt in zwei Hauptsorten. Die erste besteht aus havarirter Baumwolle und Fadenabfall; diese Substanzen sind sehr weisz und rein und werden ähnlich wie gewöhnliche weisze Lumpen behandelt und zu feinen Schreib- und Postpapieren, theils mit, theils ohne Lumpenzusatz, verarbeitet.

In weit gröszerer Menge kommt dagegen der eigentliche Baum'abfall (cotton-waste, sweepings) vor. Es ist dies der Abfall von den Maschinen, welche die Baumwolle entwirren, reinigen und zum Verspinnen vorbereiten, also von den Wölfen (dewils), kratzen u. s. w. Derselbe wird zum Theil mit dem Besen auf dem Boden zusammengekehrt, so dasz sich der ganze Kehricht der Spinnerei damit vermischt. Wie er auf den Höfen der Papierfabriken umherliegt, bildet er eine schwarzgraue, dem Anschein nach fast nur aus Staub, Schmutz, Stücken von Holz, Draht, Leder u. s. w. bestehende Substanz und es erscheint fast unbegreiflich, wie sich ein recht schönes weiszes Papier, in einer selbst für bessere Druck- und Zeitungspapiere, ganz genügende Reinheit aus solchem Material herstellen läszt.

Dieser Abfall wird in den Papierfabriken zuerst auf Sortirtische gebracht, dort ganz oberflächlich mit der Hand von dem gröbsten Unrath, vornehmlich von den gröszeren Stücken Holz, Draht und Leder gereinigt und hierauf einmal trocken gewolft. Dieser Wolf (devil) besteht
aus einem Cylinder mit langen Zähnen, die mit groszer Schnel-
797 ligkeit über ein aus Eisenstäben gebildetes Gitter wegstreichen,

*Aus den Noten zum amtlichen Berichte über die Londoner Industrie-Ausstellung von dem in der Papierindustrie wohl bewanderten Herrn Wilhelm Oechelhäuser (gegenwärtig Bürgermeister zu Mühlheim a. d. Ruhr). Des leichten Bezuges wegen haben wir einige Hefte kommen lassen und empfehlen dieselben den Herren Papierfabrikanten, da die vorzügliche Art und Weise, wie Herr O. die Papierindustrie behandelt hat, manche Ergänzung zu unserm Berichte liefert.—DIE RED.

durch welches der Schmutz hindurchfällt. Hierauf wird der schon etwas gereinigte Abfall mit Kalk- oder Sodalauge gekocht, und zwar nicht mit Hochdruck, sondern in offenen Kesseln, wobei indesz sehr darauf zu sehen ist, dasz die Lauge gehörig zirkuliren kann; hierauf bringt man ihn in den Holländer und mahlt ihn zu Halbstoff und zwar ziemlich kurz. Dieser Halbstoff wird unter hydraulischen Pressen sehr stark ausgepreszt und sodann beginnt die eigentliche Reinigung in Wölfen mit zwei Cylindern. In feuchtem Zustande sondern sich nämlich die anhängenden Unreinigkeiten weit besser aus als in trockenem, weshalb man in England diese Reinigungsmethode sogar bei Halbstoff aus ordinären leinenen und hänfenen Lumpen häufig zur Anwendung bringt. Für ordinäre Sorten läszt man den Halbstoff nur einmal den Doppelwolf passiren und bringt ihn dann sofort in den Ganzzeughollänger. Für bessere weisze Papiere dagegen wird er zweimal gewolft, hierauf in einer schwachen Chlorauflösung gebleicht, was sehr leicht vor sich geht, und dann erst zu Ganzstoff gemahlen.

Der Baumwollabfall wird sehr häufig ohne allen Zusatz, sonst aber mit etwas Abfall der Leinenspinnerei oder Packlumpen verarbeitet. Das Papier wird sehr fest und nur bei längerem Gebrauch verliert es etwas leichter den Angriff, wie das Fabrikat aus leinenen oder Hanflumpen. Viele der groszen englischen Zeitungen bestehen zu $\frac{9}{10}$ aus Baumwollabfall. Ueberhaupt wird der praktische Fabrikant keine Parallele zwischen dem aus abgetr'genen baumwollenen Lumpen
798 und dem aus frischer Baumwollfaser angefertigten Papier ziehen wollen.

Obgleich bei Packpapieren aus Baumwollabfall der Abgang 40 Procent, bei feineren weiszen Papieren sogar 60 Procent beträgt, sind dennoch die Mengen, welche England aus diesem Material anfertigt, ganz enorm. Auf die 21 Millionen Baumwollspindeln, welche England besitzt, entfallen im Ganzen mindestens 30 Millionen Pfund Abfall, der fast ausschlieszlich von den Papierfabriken benutzt wird. Zuzüglich des Leinen- und des Emballageabfalles, die damit zusammen verarbeitet werden, kann man auf ein jährliches Quantum von 16 bis 20 Millionen Pfund Papier aus diesen Materialen rechnen, was etwa $\frac{1}{7}$ der gesammten englischen Papierproduktion ausmacht.

Der als Zusatz verarbeitete Abfall der Leinenspinnerei wird ähnlich behandelt, wie der Baumwollabfall.

Die Strohpapierfabrikation Englands unterscheidet sich von der deutschen darin, dasz bei uns die Verkleinerung des Materials weit mehr auf mechanischem Wege vor sich geht, während in England das Stroh in starken Laugen unter einem Dampfdruck von 6 bis 8 Atmosphären (in Deutschland kocht man in offenen Gefäszen) ein oder mehrmals gekocht und somit gleichsam aufgelöst wird. Nachträglich werden dann Quetschrollen, ähnlich wie in unseren Oelmühlen, angewandt, so dasz dem Holländer fast gar keine Arbeit übrig bleibt. L. B. Wright, in Chalfort, bei Stroud (Gloucester), hat es am wei-
799 testen in der Darstellung besserer Papiergattung aus bloszem Stroh, ohne allen Lumpenzusatz, gebracht. Uebrigens hat die englische Strohpapierfabrikation in den auszerordentlich hohen Lumpenpreisen und den wohlfeilen Kohlen, eine bessere ökonomische Grundlage und ganz andere Stellung zur Lumpenpapierfabrikation als bei uns. Für die Anfertigung ordinärer Papiergattungen wird die Verwendung des Strohs sicherlich in Zunehmen bleiben; dagegen dürfte es vergeblich sein, dies auch für feinere Papiere durchsetzen zu wollen.

800 EXHIBIT No. 27.—R. E. S., *Examiner.*

The U. States Patent-Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from a printed volume in the library of this office, entitled "Amtlicher Beridt über die Industrie-Austellung" zu London. Zweiter Theil. Berlin, 1852.

In testimony whereof I, T. C. Theaker, Commissioner of Patents, have caused the seal of the Patent-Office to be hereunto affixed, this second day of August, in the year of our Lord one thousand eight hundred and sixty-six, and of the Independence of the United States the ninety-first.

[SEAL.] T. C. THEAKER.

801 Amtlicher Beric't über die Industrie-Ausstellung aller Völker, zu London, im Jahre 1851, von der Berichterstattungs-Commission der deutschen Zollvereins-Regierungen. Zweiter Theil. * * * Berlin, 1852. * * * p. 328. XVII. Klasse.

Papier und Papierarbeiten, Schreib- und Druckereibedürfnisse, Buchdruck- und Buchbinderarbeiten.

Bericht'statter Wilhelm Oechelhäuser, aus Siegen (Abschn. I.) Professor Dr. Hülsze, aus Dre'den (Abschn. II. bis VII.)

ABSCHNITT I.—*Papier aller Art, Pappen und Preszspähne.*

§ 67.—EINLEITUNG.

Der Umstand, dasz die einfachen Papierfabrikate nicht besonders geeignet erscheinen, auf einer Ausstellung dem Auge des Beschauers zu imponiren, mag zunächst die Veranlassung sein, dasz hierin die Zahl der Aussteller verhältniszmäszig kleiner war, als bei manchen andern Industriezweigen von weit geringerer Bedeutung. Nicht minder mag der Umstand eingewirkt haben, dasz seit der allgemeinen Einführung der Maschinen, tiefgehende und auf die Technik order Oekonomie des Betriebs bedeutend influirende Aenderungen kaum mehr stattgefunden haben, so dasz nicht allzuviel Neues in diesem Fache aufzuweisen
802 war, meist nur Resultate länger bekannter Methoden und Einrichtungen.

Wenn übrigens auch bei den einzelnen Ländern manche berühmte Firma und manche Specialität, worin sich diese oder jene Gegend auszeichnet, fehlten, so gewährte die Ausstellung doch in ihrer Totalität ein ziemlich vollständiges und getreues Bild des gegenwärtigen Standes der Papierfabrikation, indem fast jede Richtung angedeutet war, welche die Fortschritte und Neuerungen der jüngsten Zeit in diesem Fache genommen haben. Die Besprechung der einzelnen Länder wird am besten Gelegenheit bieten, dieselben hervorzuheben.

Wir wenden uns zuerst zur britischen, dann zur französischen und deutschen Papierfabrikation und schlieszen mit den übrigen Ländern.

§ 68.—GROSSBRITANNIEN UND IRLAND.

Erst im Jahre 1588 ward die erste Papierfabrik in England, in Dartford (Kent), durch einen Deutschen, Namens Spielmann, errichtet,

dem die Königen Elisabeth dafür die Ritterwürde ertheilte.[1]) Die Grafschaft Kent ist von dieser Zeit an der Hauptsitz der Handpapierfabrikationen geb'ieben und die Firma von I. Whatman, in Turkey Mill, bei Maidstone, ist noch heute, in Bezug auf Qualität ihres Fabrikats, eine der ersten Büttenfabriken Europas, deren Wasserzeichen in allen Ländern nachgeahmt werden, in grösserem Umfang vielleicht, als dies noch in der ganzen Handelswelt mit irgend einem Fabrikzeichen der Fall gewesen ist.

Die Papiermaschine ist keine englische, sondern eine französische Erfindung, jedoch haben die Engländer das vielleicht gleich
803 grosze Verdienst, dieselbe zuerst bei sich aufgenommen und vollständig ausgebildet, dem Kontinent zurückgegeben zu haben.

Im Jahre 1801 nahm I. Gamble, in Verbindung mit L. Didot, ein Patent auf die Papiermaschine und 1803 kam der erste, allerdings sehr unvollkommene Versuch der Anfertigung endlosen Papiers zu Stande. Gamble trat 1804 das Patent an die Gebrüder H. und S. Fourdrinier ab. Nächst dem ersten Erfinder Robert gebührt diesen Männern das gröszte Verdienst um die Ausbildung dieser wunderbaren Maschine; in England trägt sie auch noch fortwährend deren Namen. Gleichwohl erndteten dieselben die Früchte ihrer Anstrengungen nicht, setzten vielmehr ihr ganzes Vermögen bei den Versuchen zu Betrachtete man auf der Ausstellung das Model der Fourdrinierschen Papiermaschine aus dem Jahr 1806, so muszte man erstaunen, wie wenig dieselbe von der gegenwärtigen Konstruktion (vergl. Th. I. § 158) abweicht.

Die Wattsche Dampfmaschine dürfte das einzige Analogon in der Industriegeschichte sein, wo eine so groszartige und komplizirte mechanische Vorrichtung von ihrem Urheber gleich fertig hingestellt ward, so dasz unser erfindungsreiches Jahrhundert noch keine prinzipiellen Aenderungen der ursprünglichen Konstruktion ausgesonnen hat, die als wesentliche Verbesserungen zu betrachten wären. Wenn übrigens die Schwierigkeiten des Papiermaschinenbetriebs nur sehr langsam und allmälig überwunden wurden, so dasz mindestens 25 bis 30 Jahre vergingen, ehe die zum praktischen Betrieb nöthige Sicherheit vollständig erreicht war, so lag dies vornehmlich in dem Umstand, dasz gleichzeitig die Fabrikation von Metallgeweben und endlosen Filztü-
804 chern ausgebildet werden muszte, von deren Beschaffenheit der gute Gang einer Papiermaschine so wesentlich abhängt.

Nächst den Gebrüdern Fourdrinier hat sich der Ingenieur Bryan Donkin (Bermondsey, London), die gröszten Verdienste um Ausbildung der Erfindung Robert's errungen. Donkin war schon bei dem Bau der ersten Maschine, im Jahre 1803, als Gehülfe thätig und hat seitdem in ganz Europa den gröszten Ruf im Papiermaschinenbau erlangt; auch ein sehr bedeutender Theil der Maschinen in Deutschland stammt aus dessen Werkstätte. Mit der Zeit ist er allerdings noch von andern Ingenieuren hierin erreicht worden, z. B. von Chapelle und von Sanford und Varall (jetzt Varall, Middleton und Elwell), in Paris; Eschen, Wysz und Comp., in Zürich u. s. w.

Die Hauptsitze der britischen Papierfabrikationen sind:

1. Kent, fertigt meistens seine Schreib-, Post- und Zeichenpapiere, darunter noch viele von Hand gearbeitet.

2. Herfortshire, Buckinghamshire und Oxfordshire, meistens Zeichtungsdruck- und mittlere Sorten.

3. Lancashire, meistens Druckpapiere, mittlere und ordinäre Sorten, aus Abfällen der Baumwollspinnerei angefertigt.

4. Schottland, alle Sorten.

Auszer diesen Distrikten, wo die Papierfabriken in gröszerer Zahl zusammenliegen, finden sie sich auch über alle anderen Theile der drei Königreiche zerstreut. Die groszartigsten Establissements liegen in Lancashire; dort giebt es einzelne Fabriken mit 8 bis 9 Papiermaschinen und mehr als 50 Holländern. Im Ganzen zählten 1851:
805 England 304, Schottland 48 und Irland 28, das ganze vereinigte Königreich also 380 Papierfabriken.

Ueber den Umfang der britischen Papierfabrikation existiren genauere sta'stische Data als von irgend einem Lande, weil eine beträcht'iche innere Steu'r davon erhoben wird. Dieselbe ward 1711 zur Deckung der bedeutenden Kosten, welche die damaligen Kriege erforderten, durch die Königin Anna auferlegt und betrug bis 1836, vom Schreib- und Druckpapier 3 Pence und von allen ordinären Sorten 1½ Pence pro Pfund. Seitdem wird sie gleichmäszig für alle Sorten mit 1½ Pence (1¼ Sgr.) erhoben. Bei der Ausfuhr von Papier wird der Betrag zurückerstattet. Dasz eine so auszerordentliche hohe Besteuerung von etwa 30 Prozent des durchschnittlichen Werthes die Produktion und Konsumtion hemmen musz, liegt auf der Hand. Die versteuerte Papierproduktion hat betragen:—

1803		31, 699, 537	Pfund.
1821		48, 204, 927	"
1831		62, 738, 000	"
1835		74, 042, 650	"
1836		82, 108, 947	"
1837		88, 950, 845	"
1838		93, 466, 286	"
1839		97, 643, 823	"
1840		97, 237. 358	"
1841		97, 103, 548	"
1842		96, 693, 322	"
1843		103, 449, 625	"
1844		109, 495, 148	"
	1845	124, 247, 070	"
806	1846	127, 442, 480	"
	1847	121, 965, 312	"
1848		121, 820, 227	"
1849		132, 132, 657	"

Von dem Quantum des letzten Jahres entfielen auf—

England	98, 916, 823	Pfund.
Schottland	26, 943, 272	"
Irland	6, 272, 562	"

Die Papiersteuer trug ein—

1803	394, 824	Lstr.
1821	597, 867	"
1831	728, 860	"
1841	637, 254	"
1849	867, 121	"

Trotz dieser Steigerung des Papierverbrauches ist derselbe dennoch, im Verhältnisz zu der auszerordentlich starken Konsumtion sonstiger Industrieerzeugnisse, relativ durchaus nicht bedeutend zu nennen.

Der Papierverbrauch auf den Kopf der Bevölkerung war—

1803	1. 92	Pfund.
1821	2. 27	"
1831	2. 54	"
1839	3. 58	"
1849	4. 49	"

Gegenwärtig is hiernach der Papierverbrauch in England dem Gewichte nach etwas stärker als im Zollverein. Berücksichtigt man indesz die auszerordentliche Stärke der englischen Papiere, die mindestens das auf dem Kontinent für gleiche Formate übliche Gewicht
807 um 20 bis 30 Prozent überzeigt, so erscheint die verbrauchte Oberfläche (worauf es beim Papier doch ankommt) in Groszbritanien geringer als im Zollverein. Im Handel und im Bücherdruck ist den Papierkonsum England's ungleich stärker; auch die groszen Zeitungen verbrauchen weit mehr, als bei uns. Dagegen ist die Zahl der periodisch erscheinenden Zeitungen und Zeitschriften in England verhältniszmäszig kleiner als in Deutschland, und ganz ungleich geringerer ist überdies der Papierverbrauch der Schulen und der unteren Volksklassen. In deren Interesse musz namentlich die Aufhebung der Papiersteuer dringend gewünscht werden.

Der Umfang der britischen Papierfabrikation ist übrigens noch bedeutender als obige Produktionsnachweise angeben, indem trotz der theuren Preise nicht unbedeutende Quantitäten von Papier und Papierwaaren ausgeführt werden. Dem Werthe nach betrug diese Ausfuhr im Jahre 1849 für 314,704 Lstr., was dem Gewicht nach etwa 10 Millionen Pfund ausmachen wird. Die Summe der Produktion wäre demnach im Jahre 1849 etwa 142 Millionen Pfund gewesen.

Bei den enorm hohen Zöllen von 4½ Pence pro Pfund Papier oder mehr als 14 Rthlr. pro Ctr. (90 Prozent, oder nach Abzug der inneren Steuer, etwa 60 Prozent des durchschnittlichen Preises deutscher Papiere), kann natürlich eine Einfuhr von irgend einer Bedeutung nicht stattfinden. Dennoch ist in den letzten Jahren aus Deutschland etwas Postpapier und seines Schreibpapier dorthin gegangen, so wie auch einiges zum Reexport.

Dagegen findet eine nicht unbedeutende Einfuhr von Hadern
808 statt, meistens aus den deutschen Nordseehöfen, Italien, Ungarn und den Kolonien. Sie betrug—

1848	143,820	Ctr.
1849	139,060	"

Die Preise der Hadern in England sind sehr hoch. Die feinsten weiszen Lumpen werden bis 10 Rthlr. vom Ctr. bezahlt. Hosenlumpen mit circa 6 Rthlr., die Packlumpen mit etwa 3½ Rthlr., selbst Baumwollabfall (cotton-waste), worunter aller Kehric't der Spinnereien, kostet gegen 2 Rthlr., seinerer Baumwoll- und Fadenabfall aber mehr als das Doppelte.

Die Preise der Rohmaterialien sind seit längerer Zeit eher gestiegen als gefallen. Welche Preisreductionen indesz auf Rechnung des Uebergangs zum Maschinenbetrieb kommen, ergiebt sich aus folgender Vergleichung der Preise einer bestimmten Sorte Druckpapier.[2])

1801	36	Sch.
1808	40	"
1811	35	"

1821	27 Sch. 6 Pence.
1831	24 Sch.
1841	17 "
1843	15 Sch. 6 Pence.

Seit 1843 waren die Reduktionen nicht bedeutend mehr.

Gehen wir nun zu einer Vergleichung der ausgestellten Fabrikate über, so läszt schon die oberflächlichste Untersuchung einen sehr characteristischen Unterschied zwischen den britischen und den Papieren aller übrigen Länder wahrnehmen. Abgesehen von der auszerordentlichen Stärke, in der fast alle gangbaren Sorten angefertigt werden, zeigt sich dieser Unterschied in einer sehr harten und bei allen Schreib- und Postpapieren bis zum höchsten Grade geglätteten Oberfläche, sowie in einem äuszerst festen, pergamentartigen Angriff. Dasz
809 es in diesen Eigenthümlichkeiten, die aus gleichem und gleich gut verarbeitetem Material hergestellten Papier von Frankreich, dem Zollverein u. s. w. übertrifft, hat seine Ursache in der nachträglichen Anwendung des thierischen Leims und einer dadurch bedingten zweiten Anfeuchtung und Trocknung des Papiers, welche Methoden in England fortwährend für alle besseren Sorten (selbst für die meisten Zeitungspapiere) in Anwendung kommen, während man sie in den andern Ländern mit dem Uebergang von Bütten auf Maschinen fast vollständig verlassen hat.

Die Gründe, weszhalb man diese Methoden in England beibehielt, in anderen Ländern aber aufgab, sind weniger bei den Papierfabrikanten als vielmehr in den Gewohnheiten und Geldverhältnissen der verschiedenen Völker zu suchen.

Der Engländer zahlt lieber den höheren Preis, als dasz er seine gewohnten Ansprüche an ein dickes, festes und hartes Papier nur einigermaszen herabstimmt, oder seine Liebhaberei für die thierische Leimung daran giebt; während umgekehrt auf dem Kontinent der Preisunterschied zwischen thierisch und vegetabilisch geleimtem Papier vollständig hinreicht, die grosze Menge der Konsumenten mit dem kleinen Qualitätsunterschiede zu versöhnen, womit das gewöhnliche Maschinenpapier gegen das mit thierischem Leim nachgeleimte und zum zweiten Male langsam getrocknete zurücksteht. Es kann also aus diesen Vershiedenheiten keineswegs gefolgert werden, als sei überhaupt die Papierfabrikation in England weiter als bei uns; das blos vegetabilisch geleimte Maschinenpapier, wie es in England nur für den Bü-
810 cherdruck zur Anwendung kommt, übertrifft das deutsche, französische oder belgische keineswegs. Man kann vielmehr im Gegentheil behaupten, dasz die Methode der vegetabilischen Leimung auf dem Kontinent viel weiter ausgebildet ist, als in England, so dasz einzelne unserer renommirtesten Fabrikendas einfach in der Büttege leimte Maschinenpapier in einer Qualität darstellen, welche das doppelt geleimte englische in seinen Eigenthümlichkeiten fast vollständig erreicht.

In Bezug auf die Anstellung eines solchen Vergleiches war es namentlich zu bedauern, dasz Gebrüder Canson, aus Annonay, und die Patentpapierfabrik in Berlin, keine Muster ihrer Fabrikate ausgestellt hatten.

Als die Maschinen in Groszbritannien zuerst aufkamen ward das Papier auf denselben ganz ohne Leimzusatz angefertigt und alsdann nach der alten Methode mit der Hand in thierischem Leim geleimt und an der Luft getrocknet. Diese Verfahrungsart kommt indesz nur in ganz geringem Umfange mehr zur Anwendung. Man pflegt jetzt im

Holländer etwas vegetabilischen Leim zuzusetzen, während die nachfolgende animalische Leimung auf den hinter der Papiermaschine besonders dazu konstruirten Apparaten vor sich geht. Die einfachste Einrichtung dieser Art besteht darin, hinter der normalen Papiermaschine ein Paar Walzen anzubringen, deren untere in heiszen Leim taucht. Der Bogen passirt diese Walzen, wodurch er gleichförmig mit Leim getränkt wird, und geht alsdann unmittelbar auf ein zweites System von zwei, drei oder mehr Trockenwalzen über. Es ist
811 übrigens klar, dasz hierbei der thierische Leim nicht gehörig eindringt, auch durch die rasche Trocknung gröszentheils wieder zerstört wird, sowie sich der Bogen auch nur in geringem Grade zusammenziehen kann. Maschinen dieser Konstruktion werden daher meist nur für Zeitungs- und seltener für Schreib- und Postpapier angewandt. Am weitesten davon entfernt und am nächsten der früheren Methode der Handleimung und Lufttrocknung sind *sind* die Konstruktionen, wobei der von der Papiermaschine kommende, demnächst durch thierischen Leim geführte und längere Zeit dessen Einwirkung ausgesetzte Bogen ein ganzes System von Leitwalzen und Haspeln, im Innern mit Windrädern versehen, passirt, die in einem mäszig geheiztem Zimmer angebracht sind. Der Bogen macht auf diese Weise einen Weg von 100 bis zu 300 Fusz, und erst zuletzt, wo er nur eben noch feucht ist, passirt er eine Trockenwalze, was dann dem Leim nichts mehr schadet, wohl aber der Härte und dem Angriff des Papiers nützlich ist. Bei einer so langsamen Trocknung wird die Wirkung des thierischen Leims nur wenig beeinträchtigt; auch kann der Bogen sich vollständig in der Länge wie in der Breite zusammenziehen, was für die Festigkeit und Härte des Papiers von gleicher Bedeutung ist, wie die zweite Leimung an und für sich. Denn die etwas gröszere Brüchigkeit des Maschinenpapiers, im Vergleich zum Büttenpapier, beruht ja zum gröszten Theil in dem Umstand, dasz es sich bei dem raschen Trocknen in der Länge gar nicht und in der Breite nur unbedeutend zusammenzieht,
812 während sich bei der Lufttrocknung die Fasern näher und dichter zusammenlegen können. Zwischen den zwei erwähnten Systemen von Maschinen, die auf die thierische Leimung eingerichtet sind, giebt es nun eine Menge von Konstruktionen,[3]) die sich dem erst- oder letzterwähnten System mehr nähern. Je schneller die zweite Trocknung, desto s'wächer treten die Wirkungen der thierischen Leimung hervor, während nach der andern Richtung hin mit der Vollkommenheit des Fabrikats allerdings auch die Kosten der Anlage und Unterhaltung wachsen.

Bei der gewöhnlichen deutschen oder französischen Papiermaschine hat der trockene Bogen ungefähr dieselbe Oberfläche, welche er in naszem Zustand auf dem Sieb einnahm. Denn das geringe Einschrumpfen in der Breite gleicht sich ungefähr gegen die $\frac{1}{2}$ bis 1 Prozent betragende Verlängerung aus, die der gespannte feuchte Bogen bei den Uebergängen zwischen Gautsch-, Presz- und Trockenwalzen erleidet. Würde man denselben Bogen vom Sieb abgenommen (oder den bereits getrockneten Bogen nochmals ganz nasz gemacht) und an der Luft getrocknet haben, so schrumpfte er dadurch auf etwa $\frac{9}{10}$, ja bei sehr festem Material und weichem Stoff selbst bis zu $\frac{4}{5}$ des früheren Flächeninhalts zusammen. Es liegt auf der Hand, um wie viel fester der Bogen hierdurch werden musz und wie grosz bei den verschiedenen Methoden, das Maschinenpapier nachträglich zu leimen und zum zweiten Mal zu trocknen, der Spielraum ist, in welchem sich die Resultate denen der früheren Leimung und Lufttrocknung nähern oder denselben ferner bleiben können.

813 Die Anwendung des thierischen Leims wird übrigens in England häufig sehr übertrieben, so dasz der Bogen fast mehr die Eigenschaften einer dünnen Leimtafel als eines aus Papiermasse bestehenden Körpers zeigt. Dies tritt besonders stark bei den Papieren hervor, welche auf der Papiermaschine selbst mit thierischem Leim nachgeleimt werden, und unmittelbar darauf das zweite Trockenwalzensystem passiren. Weil hierbei der Leim keine Zeit hat gehörig einzudringen, und weil ihn die nachfolgende schnelle Trocknung theilweise wieder zerstört, auch nur ein unbedeutend stärkeres Einschrumpfen des Bogens zuläszt, als bei der ersten Trocknung stattfind, so suchen die Fabrikanten diese Mängel durch ein Uebermasz sehr starken Leims zu ersetzen. Hierdurch wird wohl der Angriff gebessert, ohne aber der eigentlichen Festigkeit wesentlich zu nützen; auch wird wohl die Haltbarkeit der Leimung erzielt, allein es kommt dann häufig vor, dasz der Bogen beim Schreiben die Tinte nicht annehmen will, ein Uebelstand, der Jedem ausgefallen sein wird, der sich der englischen Papiere bedient. Insbesondere zeigt sich dieser grosze Uebelstand an den Stellen des Bogens, die von dem Ballen der Hand etwas erwärmt worden waren. Ueberhaupt kann der thierische Leim nur dann einen wirklichen Vorzug vor der Büttenleimung beanspruchen, wenn er nicht blos auf der Oberfläche liegt, sondern den Bogen ganz durchdringt und wenn dabei eine sehr langsame zweite Trocknung stattgefunden hat.

814 Ungeleimte Druckpapiere kennt man in England nicht. Die Bücherdruckpapiere werden mit vegetabilischem Leim in der Bütte geleimt, gerade wie in Deutschland die Schreibpapiere, und die meisten Zeitungspapiere leimt man sogar mit thierischem Leim nach.

Auszer diesem abweichenden Verfahren in Bezug auf die Leimung und was damit zusammenhängt, ist in der eigentlichen Fabrikation der Unterschied der englischen und der deutschen oder französischen Methoden nicht so grosz. Doch mag gesagt werden, dasz in Allgemeinen die Engländer den Stoff länger (langfaseriger) mahlen, und dasz sie ferner die Lumpen durch Kochen mit Hochdruck[4]) etwas stärker, durch Bleichen dagegen etwas schwächer anzugreifen pflegen.

Die englischen Schreibpapiere werden auszerordentlich stark geglät'et und zwar zwischen polirten Messingplatten, während man in Deutschland Zinkplatten hierzu verwendet. Die auszerordentliche Glätte wirkt häufig mit der überstarken Leimung dahin zusammen, dasz, wie bemerkt, das Papier die Tinte nicht annimmt; im Uebrigen ist sie nur angenehm und erhöht das Ansehen des Papiers ungemein.

Im Färben der Papiere stehen die Engländer gegen die Franzosen und Deutschen etwas zurück. Die gewöhnlichen Schreib- und Postpapiere kommen in drei Nuancen vor:

1. Cream, milchweisz, gar nicht gebläut.
2. Yellow,[5]) bläulich.

815 3. Blue, sehr stark gebläut, weit stärker, als dies in Deutschland gebräuchlich ist.

Die letztere Färbung ist die für Schreib- und Postpapiere die beliebste; dann folgt Cream; am seltesten sieht man die Zwische'stufe, Yellow. Weil für so starke Bläuung ein groszer Aufwand von Farbe erforderlich ist (bis zu einigen Pfunden Ultramarin auf den Ctr. Papier), so ist demnach in England der Unterschied zwischen den Preisen der Cream und Blue Papers weit bedeutender, als dies in Deutschland vorkommt.

Zum Bläuen verdrängt das Ultramarin die Schmalte (Kobaltblau) immer mehr. Aber abgesehen davon, dasz die Anwendung des erstgenannten Farbmittels sich nur schwierig mit der animalischen Leimung

verträgt, verstehen auch die wenigsten Fabrikanten dasselbe gehörig mit dem Stoff zu verbinden. Namentlich zeigen die dicken, stark gebläuten Schreib- und Postpapiere sehr häufig eine ungleiche Vertheilung der Farbe; am auffallendsten ist dies aber bei solchen Sorten, worin mittelst Dandy-Rollers Rippen und Wasserzeichen eingedrückt worden sind. Dieselben treten häufig auf der einen Seite des Bogens so auffallend hervor, als ob sie mit weiszer Farbe auf blauen Grund gedruckt worden wären. Im Durchschnitt stehen die englischen Papiere im Lüstre und in Gleichmäszigkeit der Farbe den deutschen und noch mehr den französischen nach.

Ein so eigenthümliches Festhalten an alten Gewohnheiten, wie der englische Konsument in Bezug auf die animalische Leimung offenbart, zeigt er auch in seiner Vorliebe für das gerippte Papier (laid
816 paper) und für die Wasserzeichen. Seitdem man Beides auf einfache Weise mit den Dandy-Rollers (Égoutteurs, Siebwalzen), erreichte, wird der gröszte Theil des englischen Maschinen-, Schreib- und Postpapiers dem früheren mit Drahtformen geschöpften Handpapier so ähnlich angefertigt, dasz nur ein Kenner beides zu unterscheiden vermag. Die Ausstellung lieferte davon den Beweis.

Wenn aber schon das gewöhnliche gerippte keineswegs schöner genannt werden kann, als das glatte Velinpapier (wove paper), so ist es sicherlich eine wahre Verirrung des Geschmacks, wenn in neuerer Zeit das sogenannte Damasc laid paper in Mode gekommen ist, wobei die Rippen (also die Schuszdrähte der Dandy-Rollers) nicht gerade laufen, sondern zwischen den einzelnen, etwa 1 Zoll von einander entfernten Nähdrähten in schiefer Richtung abwechselnd auf- und absteigen. Nicht blos die Durchsicht, sondern auch das ganze äuszere Ansehen des Papiers wird hierdurch verdorben.

Die Wasserzeichen werden, wie früher auf die Formen, jetzt auf die Dandy-Rollers aufgenäht. Da jede englische Maschine mit einem Querschneidapparat versehen ist,—eine Einrichtung, die wir den deutschen Fabrikanten nicht genug anempfehlen können,—so läszt sich deren Gang so leicht reguliren, dasz jedes Wasserzeichen in die Mitte des Bogens fällt. Freilich erfordert jedes Format auch seinen besondern Dandy-Roller.

817 Nachdem wir in solcher Weise die Eigenthümlichkeiten der englischen Papiere im Allgemeinen hervorgehoben, können wir in Bezug auf die Ausstellung selbst ganz kurz sein. Wir nennen zuerst die gröszte Papierhandlung Englands, Venables, Wilson und Tyler in London, welche eine Zusammenstellung aller in England gangbaren Sorten, angefertigt von den besten Fabrikanten, veranstaltet hatte. Wir erwähnen darunter der unübertrefflichen Büttenzeichnenpapiere von J. Whatman, auf Turkey Mill (Kent); der Maschinenzeichnenpapiere von George Wilmot; der Kupferdruckpapiere von Ch. Venables; der Schreib-, Brief- und Druckpapiere von Venables und Comp.; der Seidenpapiere von R. Crompton; der Umschlagpapiere von H. Alnut u. Sohn u. s. w.; von W. Joynson, in St. Mary's Gray (Kent), besonders feine weisze und seine Postpapiere. Dieser Fabrikant hat groszen Ruf in feinen Sorten. Er fertigt dieselben auf einer der gröszten Papiermaschinen, die wohl existiren. Sie hat zwei Reinigungsvorrichtungen und zwei Saugapparate (wie dies in England gewöhnlich ist), zwei Naszpressen und ein erstes Trockensystem von 5 Trockenwalzen; dann passirt der Bogen zweimal nach einander heiszen thierischen Leim, und geht hierauf auf das zweite Trockensystem über, das aus 8 Trockenwalzen besteht, wovon die ersten mit Tuch überzogen sind; endlich passirt er zwei Systeme von je sieben übereinander liegenden geheizten Glattwal-

zen, und gelangt zuletzt auf die Längen- und Querschneidmaschine. Die ganze Maschine ist fast 100 Fusz lang und arbeitet selbst bei ganz feinen Sorten mit einer Schnelligkeit von 50 Fusz in der Minute, bei ordinairen Papieres bis 60 Fusz. Wenn aber auch die Papiere
818 von Joynson in Weisze, Reinheit, Durchsicht und Angriff in England fast nicht übertroffen werden, so zeigen sie dennoch die kleinen Fehler, welche wir oben bei dem auf der Maschine animalisch geleimten Papier hervorhoben, etc. etc., sie nehmen häufig die Tinte nicht an und es erscheint auch die Schrift, trotz der sehr haltbaren Leimung, etwas transparent, eine Eigenthümlichkeit aller Maschinenpapiere die so schnell und in solcher Spannung getrocknet sind, dasz die Fasern sich nicht so dicht zusammenlegen, wie dies bei langsamerer Trocknung der Fall gewesen sein würde.

Eine Vergleichung der Papiere von Joynson mit denen von A. Cowan und Söhne, in Valleyfield, bei Edinburg, den ersten Fabrikanten Schottlands, zeigte deutlich, dasz jene Fehler den angeführten Ursachen entspringen. Denn das Fabrikat Cowans ist frei davon. Allerdings geschieht auch bei Cowan [6]) die animalische Leimung und nachherige Trocknung mit Hülfe der Maschinerie, allein nicht in einer ununterbrochenen mechanischen Aktion und weit langsamer als bei Joynson. Bei Cowan wird das nur wenig oder gar nicht in der Bütte geleimte Papier, wie es die Trockenwalzen der normalen Papiermaschine verläszt, auf Rollen aufgewickelt. Diese bringt man auf die Leimmaschine, wo der Bogen durch heiszem Leim geführt und dann abermals aufgerollt wird. Diese Rollen läszt man mehrere Stunden liegen, damit der Leim gehörig in den Bogen eindringen kann. Alsdann bringt man sie auf eine Trockenmaschine mit Windrädern in einem mäszig erwärmten Zimmer (nach dem oben erwöhnten System), wobei dem Bogen sehr langsam die Feuchtigkeit entzogen wird. Das so erzielte Papier ist dem nach
819 Joynsons Methode fabrizirten vorzuziehen; es nimmt beim Schreiben die Tinte besser an und ist nicht so durchscheinend. Im Uebrigen war das Papier von Cowan nicht ganz so rein und so weisz, wie das von Joynson.

Bei den Ausstellungen feiner Papiere von Gebrüder Spicer und von De la Rue u. Comp., in London (angefertigt von den verschiedensten Fabrikanten), ist in'besondere auch der luxuriösen und geschmackvollen Verpackung zu erwähnen. In Quart, Oktav, Duodez und Sedez waren die Postpapiere, meist in Päckchen von 5 Buch, in feine weisze glacirte Kartons, mit erhabenen Verzierungen in Gold und dem herrlichsten Farbendruck, eingeschlagen. Selbst die Franzosen gehen in dem Luxus der Verpackung nicht so weit, als die Engländer.

Von sonstigen Einzelnheiten heben wir hervor ein 7 Fusz 9 Zoll breites Maschinenpackpapier, von Gebrüder Spicer ausgestellt; die betreffende Maschine musz also die enorme Sieb- und Trockenwalzenbreite von 8 Fusz gehabt haben, während man sonst höchst selten über 6 Fusz hinausgeht.

Ein Aussteller, W. Wildes, in Rochester, hatte eine grosze Varietät von Wasserzeichen in Bütten- und Maschinenpapier ausgestellt, die theils durch Aufnähen der Zeichen auf die Formen oder die Dandy-Rollers, theils durch Einpressen hervorgebracht waren; jedoch sind weder diese Methoden neu, noch konnten die Muster schön oder geschmackvoll genannt werden. Die Methoden von J. H. Saunders, in Dartford, sind in Deutschland längst angewandt worden. Auch die Wasserzeichen für Büttenpapiere von Gebrüder Banks, in Chesham, zeichneten sich nicht weiter aus.

Von J. Lamb, in Newcastle-under-Tyme, waren dünne, aber
820 sehr feste, aus Hanfseilen gefertigte, ungeleimte Seidenpapiere

(pottery tissue-papers) ausgestellt, wie sie zum Uebertragen von Stein- und Kupferdruck auf Porzellan, Wedg'wood u. dgl., gebraucht werden. Dieser Fabrikationszweig wird in England in ganz auszerordentlicher Ausdehnung betrieben und die Qualität des Papiers, worauf hier so viel ankömmt, ist durchschnittlich besser als bei dem in Deutschland angefertig'en.

Das Höchste in Bezug auf relative Festigkeit des Bogens leisteten die Banknotenpapiere von J. H. Saunders, in Dartford. Ein Bogen von etwa 20 Zoll Breite und nicht stärker als dünnes Kopierpost, war über 2 Rollen gelegt, deren untere ein Gewicht von 2 Centnern trug; der Behauptung des Ausstellers zufolge würde er erst bei der doppelten Belastung reiszen. Auch die Fabrikate von J. Dewdney, aus Cullompton, verdienten ihrer Festigkeit halber Beachtung.

Kartenpapiere für Zeichnungen und Druck, Porzellanpapiere für Visitkarten u. s. w., waren besonders shön, von J. L. Turnbull in London, geliefert. Derselbe hatte auch ein schönes Sortiment von farbigen Papieren für Kreid'zeichnungen mit roher aber doch harter Oberfläche ausgestellt. Die bekannten Leistungen Frankreichs waren in diesen Proben ziemlich erreicht.

Von J. Martin, aus London, waren Papiere ausgestellt, welche durch einen von ihm erfundenen Leim, die Eigenschaft vollständiger Wasserdichtigkeit erhalten haben sollten. Durch Eintauchen in Lösungen von Gummi oder ähnlichen Stoffen ist dies wohl erreichbar; allein für die Praxis dürfte nicht viel Gelegenheit sein solche Papiere zu verwenden, wenn sie bedeutend theurer als die gewöhnlich geleimten kommen.

821 Von Packpapieren, meistens zum Einschlagen der Stahlwaaren, war eine grosze Zahl von Proben ausgestellt, ebenso von Pappen, Preszspähnen und Glanzdeckeln für alle möglichen Verwendungen; allein es war hierin nichts geleistet, was nicht in Deutschland in gleicher Vollkommenheit gemacht würde. Leider steht uns nur der Rohstoff, die alten Schiffsseile, nicht in solchen Mengen zu Gebote, wie den Engländern.

Mehrere der ausgestellten Rollen Packpapier zeigten eine sehr hohe Glätte, die auf der Maschine erzeugt war, was übrigens bei so festen, starken Papieren und wo es auf verschieden geglättete Stellen und schwarze Flecken nicht ankömmt, keine besondere Schwierigkeit hat.

Ein Aussteller zeigte die Verwendbarkeit starker Pappen beim Eisenbahnwagenbau, anstatt der gewöhnlichen Holzfüllung in den Seiten- und Mittelwänden. Auch dies ist in Deutschland bereits bekannt, und z. B. auf der Leipzig-Dresdener Eisenbahn mit Pappen aus der Fabrik von Fischer, in Bautzen, durchgeführt.

Es musz übrigens schlieszlich bemerkt werden, dasz namentlich zwei Spezialitäten auf der Ausstellung fehlten, die zur vollständigen Darstellung der englischen Papierfabrikation nothwendig sind. Dies betrifft zuerst die Erzeugnisse der groszartigen Papierfabrikation von Lancashire, deren Rohstoff statt Lumpen die Abfälle der Baumwollspinnerei,[7]) gemischt mit den Abfällen der Leinenspinnerei, bilden, und woraus sehr feste schöne Papiere, in allen denkbaren Sorten, dargestellt werden. Das Gleiche gilt von der sehr weit ausgebildeten englischen Strohpapierfabrikation,[8]) deren Nichterscheinen auf der Ausstellung übrigens ein Zeichen sein mag, dasz die Darstellung feinerer Sorten aus diesem Material, wenn auch praktisch recht gut ausführbar,

822 doch keine besondern ökonomischen Vortheile gewährt und daher nicht weiter verfolgt wird.

[1]) Diese Angabe über Einrichtung der ersten Papierfabrik in England, findet sich übereinstimmend in allen gewerbhistorischen Schriften, so auch in der Encyclopedia Brittanica, part 96, pag. 11. Dürfte man sich indesz in einer solchen Frage auf Shakspeare berufen, so reicht der Ursprung der englischen Papierfabrikation viel weiter hinauf. In seinem König Heinrich VI. (zweiter Theil, Aufzug iv., Scene 6), führte nämlich der Aufrührer Cade, unter den Gründen, weszhalb er den Lord Say köpfen läszt, auch den an: "derselbe habe zum Nachtheil des Königs, seiner Krone und Würde, eine Papiermühle gebaut!"

[2]) Aus Porter's Progress of the Nation. London, 1841, pag. 569.

[3]) Ueber die verschiedenen Maschinensysteme, die in England für die thierische Leimung zur Anwendung kommen, s. den Aufsatz: Ueber den Stand der Papierfabrikation in Groszbritannien und Frankreich. Von Wilh. Oechelhäuser. Aus den Verhandlungen des Vereins für Gewerbefleisz in Preuszen. Jahrgang 1846.

[4]) Das Kochen der Lumpen geschieht meistens in verschlossenen Kesseln bei einem Druck von 2 bis 4 Atmosphären. In neuerer Zeit wendet man in England vielfach rotirende Kessel (revolving-boilers) an, theils in Form aufrecht stehender Cylinder, die sich (wie die oscillirenden Cylinder einer Dampfmaschine) um zwei Zapfen drehen, durch welche der Dampf eintritt; theils in Form von zwei liegenden
823 Cylindern, wovon der äuszere feststeht, während sich der innere um seine Achse dreht

[5]) Yellow, heiszt zu Deutsch, gelb; es ist demnach ein sehr eigenthümlicher Sprachegebrauch, gerade das gebläute Papier mit diesem Ausdruck zu bezeichnen.

[6]) Der Berichterstatter bemerkt hierbei, dasz er auf wiederholten Reisen in Groszbritannien den grösszten Theil der bedeuteren Papierfabriken genau zu besichtigen Gelegenheit hatte.

[7]) Da über die Fabrikation des Papiers aus Baumwollabfall noch nichts Genaueres in die Oeffentlichkeit gekommen sein dürfte, indem die Fabrikanten von Lancashire damit sehr geheimniszvoll sind, so läszt hier der Berichterstatter eine kurze Beschreibung der in den Papierfabriken von Manchester üblichen Methoden und Vorrichtungen folgen, wie er sie dort in den Jahren 1845 und 1846 genau kennen zu lernen Gelegenheit hatte. Im Königreich Sachsen, so wie in der Umgegend von Wien, würde sich jetzt schon eine praktische Benutzung von dem Baumwollabfall für die Papierfabrikation machen lassen, indem dort die Spinnereien dichter zusammen liegen.

Der Baumwollabfall zerfällt in zwei Hauptsorten. Die erste besteht aus havarirter Baumwolle und Fadenabfall; diese Substanzen sind sehr weisz und rein und werden ähnlich wie gewöhnliche weisze Lumpen behandelt und zu feinen Schreib- und Postpapieren, theils mit, theils ohne Lumpenzusatz, verarbeitet.

In weit grösszerer Menge kommt dagegen der eigentliche Baumwollabfall (cotton-waste, sweepings) vor. Es ist dies der Abfall von den Maschinen, welche die Baumwolle entwirren, reinigen und zum Verspinnen vorbereiten; also von den Wölfen (devils), Kratzen u. s. w. Derselbe wird zum Theil mit dem Besen auf dem Boden zusam-
824 mengekehrt, so dasz sich der ganze Kehricht der Spinnereien damit vermischt. Wie er auf den Höfen der Papierfabriken umherliegt, bildet er eine schwarzgraue, dem Anschein nach fast nur aus Staub, Schmutz, Stücken von Holz, Draht, Leder u. s. w., bestehende Substanz, und es erscheint fast unbegreiflich, wie sich ein recht schönes weiszes Papier, in einer selbst für bessere Druck- und Zeitungspapiere ganz genügenden Reinheit aus solchem Material herstellen läszt.

Dieser Abfall wird in den Papierfabriken zuerst auf Sortirtische gebracht, dort ganz oberflächlich mit der Hand von dem gröbsten Unrath, vornehmlich von den grószeren Stücken Holz, Draht und Leder gereinigt und hierauf einmal trocken gewolft. Dieser Wolf (devil) besteht aus einem Cylinder mit langen Zähnen, die mit groszer Schnelligkeit über ein aus Eisenstäben gebildetes Gütter wegstreichen, durch welches der Schmutz hindurchfällt. Hierauf wird der schon etwas gereinigte Abfall mit Kalk- oder Sodalauge gekocht und zwar nicht mit Hochdruck, sondern in offenen Kesseln, wobei indesz sehr darauf zu sehen ist, dasz die Lauge gehörig zirkuliren kann; hierauf bringt man ihn in den Holländer und mahlt ihn zu Halbstoff und zwar ziemlich kurz. Dieser Halbstoff wird unter hydraulischen Pressen sehr stark ausgepreszt und sodann beginnt die eigentliche Reinigung in Wölfen mit zwei Cylindern. In feuchtem Zustande sondern sich nämlich die anhängenden Unreinigkeiten weit besser aus als in trockenem, weshalb man in England diese Reinigungsmethode sogar bei Halbstoff aus ordinairen leinenen und hänfenen Lumpen häufig zur Anwendung bringt. Für ordinaire Sorten läszt man den Halbstoff nur einmal den Doppelwolf passiren und bringt ihn dann sofort in den Ganzzeugholländer. Für bessere weisze Papiere dagegen wird er zweimal gewolft,
825 hierauf in einer schwachen Chlorauflösung gebleicht, was sehr leicht vor sich geht, und dann erst zu Ganzstoff gemahlen.

Der Baumwollabfall wird sehr häufig ohne allen Zusatz, sonst aber mit etwas Abfall der Leinenspinnerei oder Packlumpen verarbeitet. Das Papier wird sehr fest und nur bei längerem Gebrauch verliert es etwas leichter den Angriff, wie das Fabrikat aus leinenen oder Hanflumpen. Viele der groszen englischen Zeitungen bestehen zu $\frac{9}{10}$ aus Baumwollabfall. Ueberhaupt wird der praktische Fabrikant keine Parallele zwischen dem aus abgetragenen baumwollenen Lumpen und dem aus frischer Baumwollfaser angefertigten Papier ziehen wollen.

Obgleich bei Packpapieren aus Baumwollabfall der Abgang 40 Prozent, bei feineren weiszen Papieren sogar 60 Prozent beträgt, sind dennoch die Mengen, welche England aus diesem Material anfertigt, ganz enorm. Auf die 21 Millionen Baumwollspindeln, welche England besitzt, entfallen im Ganzen mindestens 30 Millionen Pfund Abfall, der fast ausschlieszlich von den Papierfabriken benutzt wird. Zuzüglich des Leinen- und des Emballageabfalles, die damit zusammen verarbeitet werden, kann man auf ein jährliches Quantum von 16 bis 20 Millionen Pfund Papier aus diesen Materialien rechnen, was etwa $\frac{1}{7}$ der gesammten englischen Papierproduktion ausmacht.

Der als Zusatz verarbeitete Abfall der Leinenspinnerei wird ähnlich behandelt, wie der Baumwollabfall.

[8]) Die Strohpapierfabrikation Englands unterscheidet sich von der deutschen darin, dasz bei uns die Verkleinerung des Materials weit mehr auf mechanischem Wege vor sich geht, während in England das Stroh in starken Laugen unter einem Dampfdruck von 6 bis 8 Atmosphä-
826 ren (in Deutschland kocht man in offenen Gefäszen) ein- oder mehrmals gekocht und somit gleichsam aufgelöszt wird. Nachträglich werden dann Quetschrollen, ähnlich wie in unseren Oehlmühlen, angewandt, so dasz dem Holländer fast gar keine Arbeit übrig bleibt. L. B. Wright, in Chalford, bei Stroud (Gloucester), hat es am Weitesten in der Darstellung besserer Papiergattung aus bloszem Stroh, ohne allen Lumpenzusatz, gebracht. Uebrigens hat die englische Strohpapierfabrikation in den auszerordentlich hohen Lumpenpreisen und den wohlfeilen Kohlen eine bessere ökonomische Grundlage und eine ganz andere Stellung zur Lumpenpapierfabrikation als

bei uns. Für die Anfertigung ordinairer Papiergattungen wird die Verwendung des Strohs sicherlich im Zunehmen bleiben; dagegen dürfte es vergeblich sein, dies auch für feinere Papiere durchsetzen zu wollen.

827 EXHIBIT No. 28.—R. E. STILWELL, *Examiner, &c.*

No. 2666. March 20th, 1847. Mr. Gros, aux Batignolles. Copie, (French.)

828 Brevêt d'invention No. 2666. 2d series, vol. 10, page' 94, 95, 96. Printed in the year 1852.

No. 2666. Brevêt d'invention de quinze ans, en date du 20 mars 1847, au sieur Gros, aux Batignolles, (Seine,) pour l'emploi du genêt dans la fabrication du papier.

La plante du genêt peut être convertie en pâte à papier en toutes saisons; au moment même où elle vient d'être cueillie ou longtemps après, plus au moins verte ou plus ou moins sèche. Toutefois il est utile pour éviter le déchet provenant de l'abondance de la sève de cesser la cueillette du genêt pendant environ quatre mois de l'année; par example depuis 1er mai jusqu'au 1er septembre.

Le genêt, tel qu'il a été détaché du sol entier, et sans qu'il soit besoin de faire aucun triage et d'en rien retrancher, si ce n'est le bois mort, doit premièrement être soumis à un écrasement violent, qu'on peut obtenir au moyen de laminoirs ou de toute autre manière comme équivalente propre à écraser la plante sans la hacher ou la trop rompre. Ces laminoirs peuvent être unis ou rayés et cannelés. Si la plante était parvenue à un état de siccité qui la rendit cassante il
829 faudrait avant de l'écraser lui rendre de la souplesse en la mouillant.

Cet écrasement a pour objet d'assimiler en quelque sorte toutes les parties de la plante, en ramenant le gros bois lui-même à une espèce d'état filamenteux, de manières que toutes les parties du végétal se trouvent disposées à recevoir ensemble de la même manières, par les lessives ou autrement, le ramollis'ement le plus simultané et le plus égal possible. Si, après avoir passé une première fois aux laminoirs, la plante ne paraissait pas parfaitement écrasée, il faudrait la laminer une deuxième fois, et même davantage, en rapprochant de plus en plus les cylindres.

Après un laminage suffisant, on doit enlever, autant que possible, l'écorce du bois de genêt gros et moyen. Ce bois, dépouillé de son écorce, est alors mis à part pour être employé ainsi qu'il sera dit ci-après.

Toutes les autres parties de la plante, menu et moyen genêt, dont le bois n'a pu être facilement séparé, ainsi que toutes les écorces
830 enlevées, sont placées ensemble sur une aire d'écrasement unie, ou plus ou moins rayée ou cannelée en pierre, en bois ou autre matière dure non-métallique. Cette aire doit être pourvue tout autour d'une margelle, afin de retenir l'eau qu'on pourra ensuite faire écouler à volonté. Un rouleau, également en pierre ou en bois, ou toute autre matière dure non-métallique, uni, ou rayé, ou cannelé, d'un poids qu'on rendra convenable en l'augmentant ou en le diminuant à volonté par l'introduction dans chacune de ses extrémités de lingots de fonte plus ou moins pesants, doit alors, par un mouvement en ligne droite, de va-

et-vient, rouler sur la matière qu'on aura préalablement mouillée avec de l'eau de fontaine ou de rivière froide, ou plus ou moins chaude, ou même une eau chaude alcaline.

Cette opération, dont l'objet est de broyer, de réduire en fines parcelles, et par suite de détacher les parties molles gommo-résineuses et colorantes de la plante, ainsi que son épiderme ou parenchyme, qui font adhérer entre eux les filaments composant l'écorce, doit se con-
831 tinuer jusqu'à ce que l'eau, dont on arrosera presque constamment la matière et qu'on renouvellera, sorte claire, après avoir séjourné sur l'aire. La substance aura alors l'aspect d'une étoupe, plus ou moins grise, jaune ou verdâtre, suivant qu'on aura employé pour la mouiller de l'eau froide ou de l'eau plus ou moins chaude ou alcaline.

Toute cette matière doit être réduite par un coupage en brins d'environ 10 à 15 centimètres de longueur.

Ainsi écrasée, broyée, nettoyée et coupée, la substance doit ensuite être soumise, soit immédiatement, telle qu'elle soit de l'aire, soit plus tard, et à volonté, lorsqu'on l'aura fait sécher pour la conserver, à une lessive à la chaux grasse, avec ou sans addition de sel de soude ou d'autres sels alcalins, suivant la qualité de pâte qu'on veut obtenir. Cette lessive pourra durer depuis quatre heures jusqu'à douze heures. La saison pendent laquelle le genêt aura été récolté et la qualité qu'on voudra donner à la pâté détermineront la durée de cette lessive,
832 ainsi que la nature et la quantité d'agents chimiques qui entreront dans sa composition.

Pour une pâte grossière et seulement propre à la fabrication du papier de pliage ou d'emballage quatre heures environ de lessive composée de 10 p. % du volume d'eau de bonne chaux grasse, avec ébullition constante, pourrant suffire pour le genêt cueilli pendant le printemps et l'été. Mais pour le genêt récolté pendant l'automne et l'hiver on pourra avoir besoin de six à huit heures de lessive contenant jusqu'à 15 p. % du volume d'eau de bonne chaux grasse.

Pour une pâte destinée aux diverses qualités de papiers blancs il y aura lieu de lessiver de six à huit heures environ pendant le printemps et l'été, avec environ 10 p. % du volume d'eau de sel de soude et 5 p. % de chaux grasse, et huit à douze heures environ pour du genêt cueilli pendant l'automne et l'hiver, en composant sa lessive avec environ 15 à 20 p. % du volume d'eau de sel de soude rendu caustique avec environ 5 p. % de chaux grasse.

833 Le genêt est mis dans la lessive lorsqu'elle est en pleine ébullition et après que la soude et la chaux grasse y ont été introduites et dissoutes.

La substance doit ensuite, sans avoir été lavée et telle qu'on l'a retirée de la lessive, être mise à part et entassée pour rester dans cet état pendant une quinzaine de jours, après lesquels elle doit être mise à la pile-cylindre pour être lavée jusqu'à eau claire. La machine doit être peu serrée du bord, et elle ne le sera davantage que lorsqu'on procédra à l'effilochage et seulement peu à peu et progressivement. Les toiles métalliques des tambours laveurs, et autres grillages qui servent à la sortie de l'eau de la pile, doivent être beaucoup plus grossiers que ceux dont on se sert pour laver le chiffon, et cela, afin de faciliter l'expulsion des parties qui ne sont ni bois ni filament.

Après l'effilochage on presse la matière pour la débarrasser par ce moyen de la plus grande quantité d'eau possible.

Si la pâte doit être employée pour du papier de paquetage ou
834 de pliage, il faut, après avoir effilé, lorsqu'on a laissé écouler

bei uns. Für die Anfertigung ordinairer Papiergattungen wird die Verwendung des Strohs sicherlich im Zunehmen bleiben; dagegen dürfte es vergeblich sein, dies auch für feinere Papiere durchsetzen zu wollen.

827 EXHIBIT No. 28.—R. E. STILWELL, *Examiner, &c.*

No. 2666. March 20th, 1847. Mr. Gros, aux Batignolles. Copie, (French.)

828 Brevêt d'invention No. 2666. 2d series, vol. 10, page' 94, 95, 96. Printed in the year 1852.

No. 2666. Brevêt d'invention de quinze ans, en date du 20 mars 1847, au sieur Gros, aux Batignolles, (Seine,) pour l'emploi du genêt dans la fabrication du papier.

La plante du genêt peut être convertie en pâte à papier en toutes saisons; au moment même où elle vient d'être cueillie ou longtemps après, plus au moins verte ou plus ou moins sèche. Toutefois il est utile pour éviter le déchet provenant de l'abondance de la sève de cesser la cueillette du genêt pendant environ quatre mois de l'année; par example depuis 1er mai jusqu'au 1er septembre.

Le genêt, tel qu'il a été détaché du sol entier, et sans qu'il soit besoin de faire aucun triage et d'en rien retrancher, si ce n'est le bois mort, doit premièrement être soumis à un écrasement violent, qu'on peut obtenir au moyen de laminoirs ou de toute autre manière comme équivalente propre à écraser la plante sans la hacher ou la trop rompre. Ces laminoirs peuvent être unis ou rayés et cannelés. Si la plante était parvenue à un état de siccité qui la rendit cassante il
829 faudrait avant de l'é'raser lui rendre de la souplesse en la mouillant.

Cet écrasement a pour objet d'assimiler en quelque sorte toutes les parties de la plante, en ramenant le gros bois lui-même à une espèce d'état filamenteux, de manières que toutes les parties du végétal se trouvent disposées à recevoir ensemble de la même manières, par les lessives ou autrement, le ramollis'ement le plus simultané et le plus égal possible. Si, après avoir passé une première fois aux laminoirs, la plante ne paraissait pas parfaitement écrasée, il faudrait la laminer une deuxième fois, et même davantage, en rapprochant de plus en plus les cylindres.

Après un laminage suffisant, on doit enlever, autant que possible, l'écorce du bois de genêt gros et moyen. Ce bois, dépouillé de son écorce, est alors mis à part pour être employé ainsi qu'il sera dit ci-après.

Toutes les autres parties de la plante, menu et moyen genêt, dont le bois n'a pu être facilement séparé, ainsi que toutes les écorces
830 enlevées, sont placées ensemble sur une aire d'écrasement unie, ou plus ou moins rayée ou cannelée en pierre, en bois ou autre matière dure non-métallique. Cette aire doit être pourvue tout autour d'une margelle, afin de retenir l'eau qu'on pourra ensuite faire écouler à volonté. Un rouleau, également en pierre ou en bois, ou toute autre matière dure non-métallique, uni, ou rayé, ou cannelé, d'un poids qu'on rendra convenable en l'augmentant ou en le diminuant à volonté par l'introduction dans chacune de ses extrémités de lingots de fonte plus ou moins pesants, doit alors, par un mouvement en ligne droite, de va-

et-vient, rouler sur la matière qu'on aura préalablement mouillée avec de l'eau de fontaine ou de rivière froide, ou plus ou moins chaude, ou même une eau chaude alcaline.

Cette opération, dont l'objet est de broyer, de réduire en fines parcelles, et par suite de détacher les parties molles gommo-résineuses et colorantes de la plante, ainsi que son épiderme ou parenchyme, qui font adhérer entre eux les filaments composant l'écorce, doit se con-
831 tinuer jusqu'à ce que l'eau, dont on arrosera presque constamment la matière et qu'on renouvellera, sorte claire, après avoir séjourné sur l'aire. La substance aura alors l'aspect d'une étoupe, plus ou moins grise, jaune ou verdâtre, suivant qu'on aura employé pour la mouiller de l'eau froide ou de l'eau plus ou moins chaude ou alcaline.

Toute cette matière doit être réduite par un coupage en brins d'environ 10 à 15 centimètres de longueur.

Ainsi écrasée, broyée, nettoyée et coupée, la substance doit ensuite être soumise, soit immédiatement, telle qu'elle soit de l'aire, soit plus tard, et à volonté, lorsqu'on l'aura fait sécher pour la conserver, à une lessive à la chaux grasse, avec ou sans addition de sel de soude ou d'autres sels alcalins, suivant la qualité de pâte qu'on veut obtenir. Cette lessive pourra durer depuis quatre heures jusqu'à douze heures. La saison pendant laquelle le genêt aura été récolté et la qualité qu'on voudra donner à la pâté détermineront la durée de cette lessive,
832 ainsi que la nature et la quantité d'agents chimiques qui entreront dans sa composition.

Pour une pâte grossière et seulement propre à la fabrication du papier de pliage ou d'emballage quatre heures environ de lessive composée de 10 p. % du volume d'eau de bonne chaux grasse, avec ébullition constante, pourrant suffire pour le genêt cueilli pendant le printemps et l'été. Mais pour le genêt récolté pendant l'automne et l'hiver on pourra avoir besoin de six à huit heures de lessive contenant jusqu'à 15 p. % du volume d'eau de bonne chaux grasse.

Pour une pâte destinée aux diverses qualités de papiers blancs il y aura lieu de lessiver de six à huit heures environ pendant le printemps et l'été, avec environ 10 p. % du volume d'eau de sel de soude et 5 p. % de chaux grasse, et huit à douze heures environ pour du genêt cueilli pendant l'automne et l'hiver, en composant sa lessive avec environ 15 à 20 p. % du volume d'eau de sel de soude rendu caustique avec environ 5 p. % de chaux grasse.

833 Le genêt est mis dans la lessive lorsqu'elle est en pleine ébullition et après que la soude et la chaux grasse y ont été introduites et dissoutes.

La substance doit ensuite, sans avoir été lavée et telle qu'on l'a retirée de la lessive, être mise à part et entassée pour rester dans cet état pendant une quinzaine de jours, après lesquels elle doit être mise à la pile-cylindre pour être lavée jusqu'à eau claire. La machine doit être peu serrée du bord, et elle ne le sera davantage que lorsqu'on procédra à l'effilochage et seulement peu à peu et progressivement. Les toiles métalliques des tambours laveurs, et autres grillages qui servent à la sortie de l'eau de la pile, doivent être beaucoup plus grossiers que ceux dont on se sert pour laver le chiffon, et cela, afin de faciliter l'expulsion des parties qui ne sont ni bois ni filament.

Après l'effilochage on presse la matière pour la débarrasser par ce moyen de la plus grande quantité d'eau possible.

Si la pâte doit être employée pour du papier de paquetage ou
834 de pliage, il faut, après avoir effilé, lorsqu'on a laissé écouler

l'eau de la pile et quand la pâte est seulement égouttée—c'est-à-dire, deux heures environ après qu'elle a été retirée de la pile ou cylindre—mettre cette pâte dans un vase en bois et la mouiller—c'est-à-dire, l'imbiber seulement avec du chlorure de chaux, dont on se sert en papeterie. Il sera bon d'agiter la matière avec des spatules ou autrement. Environ douze heures, ou même vingt-quatre heures après, cette pâte peut être lavée et raffinée.

Lorsque la pâte doit être employée pour la fabrication de papiers blancs, il faut, après l'avoir pressée, comme il a été dit ci-dessus, la diviser en parcelles et la placer dans les boîtes à chlore gazeux. On y fait alors le vide le mieux possible, avec un appareil pneumatique; le gaz n'y est introduit qu'après. Lorsque la matière y a fait le séjour voulu pour le chiffon, on la lave avec soin et il pourra y avoir des cas—par exemple, pour obtenir des pâtes d'une plus grande blancheur—où il sera utile de la soumettre, comme précédement, à une deuxième
835 et même à une troisième action du chlore gazeux, en ayant soin de bien laver après chaque blanchiment, comme aussi de bien presser.

On termine, comme pour le chiffon, par un bain au chlorure de chaux, qu'on prolonge jusqu'à ce que l'effet en paraisse suffisant. L'action du chlore a toujours un excellent résultat pour diviser et désagréger le genêt et rendre ainsi très feutrante la pâte qui en provient; elle peut faire, dans cet acide, un séjour assez prolongé, sans rien perdre de ses bonnes qualités. En sortant du chlorure de chaux, la pâte est lavée et n'a plus ensuite besoin que d'être raffinée pour être convertie en papier.

Quant au bois, dépouillé de son écorce, qu'on a dû mettre à part après l'opération du laminage, il doit être mis à une lessive en vase clos, avec une pression de trois du quatre atmosphères environ. Cette lessive sera composée de même que celle précédement décrite et devra avoir la même durée. Après la lessive, le bois doit immédiate-
836 ment, et sans avoir été lavé, être placé sur l'aire d'écrasement et broyé avec le rouleau, jusqu'à ce qu'il présente l'aspect d'une matière textile effilochée. Après cela, il devra subir une deuxième lessive, semblable à la première, puis bien lavé au cylindre, effiloché ensuite complétement et plus fin que pour le chiffon, pressé, soumis au chlore gazeux, lavé, mis au chlorure de chaux, lavé, raffiné. Après cette dernière opération, on pourra, soit mêler ce bois avec d'autres pâtes blanches, soit l'employer seul, pour en faire un papier qui sera spécial par sa finesse soyeuse et le satiné naturel qu'il présentera, sans avoir été passé à la lisse ou avoir subi l'action d'aucun autre moyen propre à l'adoucir.

Différents autres moyens, appartenant à l'art de la papeterie, peuvent également être employés avec succès, pour obtenir de bonnes pâtes à papier faites uniquement avec le genêt. Il serait superflu de les mentionner, comme aussi d'énoncer que les pâtes provenant du genêt pourraient être mêlées utilement avec toutes les
837 variétés de pâtes propres à la fabrication du papier.

Les qualités filamenteuses et textiles du genêt commun sont depuis longtemps reconnues. Dans quelques contrées, on en retire encore une étoupe qui sert à la fabrication de toiles grossières.

Cette étoupe, ou la toile qui en provient, auront certainement pu, comme toute autre matière du même genre, être employées à la fabrication d'un papier plus au moins grossier. Mais ce qui distingue principalement l'invention qui fait l'objet de la présente description, c'est la facilité de fabriquer, par l'emploi de moyens nouveaux ou nouvellement

appliqués, avec une main d'œuvre qui n'est pas plus onéreuse que celle en usage pour le chiffon, en quelque sorte toute d'une pièce, avec le genêt commun, une pâte propre à la confection de toutes sortes de papiers, ce qui seul peut constituer une bonne opération industrielle, et que nul autre que l'inventeur soussigné n'avait pu obtenir jusqu'à ce jour.

838 EXHIBIT No. 29.—R. E. STILWELL, *Examiner, &c.*

No. 2666. March 20th, 1847. Mr. Gros, of Batignolle.—Translation.

No. 2666.—Letters-patent of 15 years, dated March 20th, 1847, to Mr. Gros, of Batignolles, Seine, for the use of broom in the manufacture of paper.

The broom-plant can be converted into paper-pulp at all seasons of the year, even from the moment when it is gathered, to a long time afterwards, when it is more or less green or more or less dry. It is always useful to prevent the drying up arising from the abundance of sap by ceasing the gathering of the broom-plant during about four months of the year; for example, from the first of May to the first of September. The broom, just as it has been detached from the ground, without the necessity of picking out and throwing any of it away, except the dry wood, must first be submitted to strong crushing. It can be crushed by means of rollers or by any other equivalent means which shall crush the plant without too much chopping and breaking it. [These rollers can either be smoothe, grooved, or fluted.] If the plant should become so dry that it breaks, it must first be made flexible by moistening
839 before crushing. The object of this crushing is to even, in some way, all the parts of the plant, in reducing the heavy wood itself to a fibrous state in such manner that all the vegetable parts are disposed to receive together in the same manner by *washing* [means of lye] or otherwise the softening influence, as much as possible simultaneously and equally. If, after having passed through the rollers once, the plant seems not to be perfectly crushed, it must be passed through a second time; and it will be of advantage to bring the cylinders closer together. After a sufficient rolling, the bark of the broom-wood—the large as well as the small—must be removed as much as possible. This wood, freed from its bark, is now laid aside to be used in the way as will be hereafter described. All the other parts of the plant and broomy matter from which the wood could not be easily separated, as well as all the bark taken off, are placed together on a crushing-plate, smooth or more or less grooved and fluted, of *iron*, [stone] wood, or other hard non-metallic material. This plate should be
840 provided with a rim all around so as to retain the water which shall be afterwards poured on at pleasure. A roller, also of stone or wood, or any other hard non-metallic material, plain, or grooved, or fluted, whose weight can be augmented or diminished at will by the introduction on each of its ends of cast-iron blocks, more or less heavy, must now, by a straight movement to and fro, be rolled over the material which has been previously moistened with well water, river water, cold or more or less hot, or even hot alkaline water. This operation, the object of which is to crush and reduce to fine particles and afterwards to detach the soft, gummy, resinous, and gluey matter from the plant, as well as the skinny film or pulp, which may cause the fibres composing the bark to adhere together, ought to continue until the water, which is almost constantly poured over the matter, after having

remained on *it*, [the plate] passes off clear. The substance has the appearance of oakum, more or less gray, yellow, or green, according as the water used is cold, hot, or more or less alkaline. All this material must be reduced by cutting it into small pieces from ten to fifteen
841 centimeters long. The substance so crushed, ground, cleaned, and cut, must be submitted, either directly as it comes from the plate, or at a later period, and at will, after it has been dried, to preserve it, to a *wash* [lye] of wood and pure lime, with or without the addition of soda-ash, or other alkaline *solution*, [salts] according to the quality of the pulp it is desired to obtain. This *washing* [treatment with lye] must last from four to twelve hours. The season in which the broom-plant has been collected, and the quantity which it is desired to give to the pulp, will determine the duration of this *washing*, [treatment with lye] as also the nature and the quantity of the chemical agents which enter into its composition. For a coarse pulp only fit for the manufacture of paper to be folded or for packing, about four hours of the wash, composed of ten per cent. of the volume of water of good and pure lime, with constant boiling, would be sufficient for the broom gathered during the spring and summer; but for the broom gathered dur-
842 ing the autumn and winter a *washing* [lye-teatment] of from six to eight hours would be necessary, the wash composed of fifteen per cent. of the volume of water of good and pure lime. For the pulp designed for the different kinds white paper a *washing* [lye-treatment] of from six to eight hours would be necessary for the broom gathered during the spring and summer; the wash being composed of about ten per cent. of the volume of water of soda-ash, and five per cent. of good and pure lime; and from eight to twelve hours for the broom gathered during autumn and winter, the *wash* [lye] being composed of from fifteen to twenty per cent. of the volume of water of soda-ash, made caustic by the addition of about five per cent. of good and pure lime.

The broom is put into the *wash* [lye] when it is fully boiling and after the soda-ash and the lime have been introduced therein and dissolved. Then the substance, without being washed, and just as it is drawn from the *wash*, [lye] must be laid aside and heaped up to
843 rest in this state for about a fortnight, after which it must be brought to the cylinder-machine to be washed to the state that the water is—clear. The machine must be pressed down very little on the side, and it would be advantageous to proceed with the grinding slowly and progressively. The metallic cloths of the washing-cylinder and other grating which serve to let the water pass off from the cylinder-machine, can be much coarser than those which are used for the washing of rags, in order to facilitate the expulsion of all the parts which are neither wood nor fibre. After the grinding the matter is pressed to disengage, by this means, as great a quantity of water as possible. When the pulp is going to be employed for packing-paper or folding, after it has been ground, and after the water has flown off from the cylinder-machine, and when the water has only just flown off from the pulp, that is to say, about two hours after it has been drawn from the cylinder machine, it must be put into wooden boxes and wet, that is
844 to say, only soaked *w*ith chloride of lime, generally used in paper-manufacture. It would be well to agitate the matter with spades or otherwise. About twelve hours—or even twenty-four hours—afterwards this pulp can be washed and refined. When the pulp is to be employed for the manufacture of white paper, it is necessary, after it has been pressed, as has been stated above, to divide it into parts and place it into boxes with chlorine-gas. As complete a vacuum as pos-

sible is produced by a pneumatic apparatus and the gas is afterwards introduced. When the material has remained the time needed for rags, it is washed with care. Cases may happen, for example to obtain a pulp of greater whiteness, where it may be useful to submit it to a second or even third action of the chlorine-gas, as before, being careful to wash it well after each bleaching, as also to press it out well. The treatment is ended as with rags with a bath of chlorid' of lime, which is prolonged until the effect seems to be sufficient. The action of the chlo-
845 rine gas has also an excellent result in dividing and disengaging the broom and making the pulp which comes from it very much like felt. It may rest in this bath for a considerable time without loosing its [good] qualities. Coming from the chloride of lime, the pulp is washed, and nothing more is necessary but to refine it, in order to convert it into paper.

The wood freed from its bark, which has been laid aside after the operation of rolling, must be submitted to a *wash* [lye] in a closed vessel, with a pressure of *from* [about] three to four atmospheres. This *bath* [lye] must be the same as those previously described and must have the same duration. After the [lye] bath the wood must be immediately, and without been washed, placed on the pressing-plate and crushed with the roller until it has the looks of a textile, oakum-like matter. After this it must be submitted to a second [lye] bath similar to the first; then well washed on the cylinders, and afterwards
846 completely ground—and much finer than rags—pressed out, submitted to chlorine-gas, washed, put into chlorid' of lime, washed, and refined. After this last operation this wood may be mixed with other white pulps, or may be used alone to make of it a paper which will be *of superior quality, and have a natural, silky, and satin-like fineness, as it will appe'r*, [which will be remarkable for its silk-like fi'ness and the natural, satin appearance which it will present] without passing it through rollers or having submitted it to the action of any other means to smooth it.

Other means belonging to the art of paper-making can also be employed with success to obtain good paper-pulp made exclusively of broom. It will be superpluous to mention them, as also to say that the pulp produced from broom might be mixed usefully *with a variety of other* [with all the varieties of] pulps used in the manufacture of paper. The fibrous and textile qualities of the common broom have been well known and long deemed good. In some countries they extract
847 from it a tow which serves for the manufacture of coarse cloth. This tow, or the cloth which is made from it, could certainly have been, as all other materials of the same kind, employed in the manufacture of paper more or less coarse; but that which mainly distinguishes the invention, which it is the object of the present discription to show, is the facility of manufacturing by the use of new means or means *lately* [newly] applied in a new manner, with hand-work, which is not more troublesome than that in use with regs, of any quality out of one material, with the common broom, a pulp fit for the manufacture of all kinds of paper, which alone constitutes a good, industrial operation, and which no others than the undersigned inventor have ever, up to this day, been able to obtain.

EXHIBIT No. 30.—R. E. STILWELL, *Examiner, &c.*

No. 9215. Paris, février 7° 1838. Montgolfier frère. Copie, (French.)

(Here follows diagram marked page 848.)

848 [Brevêts d'invention, 1st series, vol. 67, page' 15–16, plate 2.]

Brevêt d'invention de dix ans, en date du 7 février 1838, *aux sieurs Montgolfier frères, à Paris, pour la fabrication du papier de bois, ainsi que du carton de bois bituminé.*

Toutes les substances filamenteuses sont plus ou moins propres à entrer comme éléments dans la pâte de papier, qui peut être comparée à un tissu ordinaire, avec la seule différence du système de cohésion des fils ou parties filamenteuses.

Ainsi au nombre des substances on peut classer au premier rang :

1°. Le lin.
2°. Le chanvre.
3°. Le coton.
4°. L'ortie et autres plantes analogues au chanvre.
5°. La paille, le foin, le trèfle, le blé sarrasin, le maïs.
6°. La feuille de divers arbres.

Des procédés de fabrication pour traiter ces diverses substances existent imprimés; des essais nombrenx ont été faits à diverses époques; on en est revenu généralement au chanvre et au coton comme présentant le compte de produit le plus avantageux et une quantité préférable.

Toutes les autres substances que nous venons de citer ont aussi l'un des inconvénients qui suivent: ou d'êtres rares, et par suite d'un prix trop élevé, ou de faire un déchet trop considérable pour être amenées à
849 l'état de papier, ou enfin de produire un papier de mauvaise qualité, bien inférieur à celui du chanvre et du coton.

Mais si on considère alternativement toutes ces substances, on se convaincra, de plus qu'elles 'en renferment qu'une petite quantité de matière filamenteuse comparativement à leur poids et à leur prix, et que dès lors il y a un mauvais compte de produit à faire si on abandonne le chiffon pour recourir à un remplaçant fictif. Cette considération, d'une part, et l'étude faite de l'autre, de la force de traction que présente un morceau de bois à longues fibres comparées à celles d'un câble de chanvre, nous ont conduits à penser que dans ce bois, aussi bien que dans le câble, il devait exister une réunion de brins ou filaments plus ou moins analogues avec ceux du chanvre, mais qui, séparés, devaient présenter une résistance proportionelle à celle du morceau de bois avec le câble du même diamètre.

Or, qu'on en fasse l'expérience, un rondin de sapin, de peuplier, ou bois à longues fibres de 1 pouce de diamètre, présentera une force de traction égale, si non supérieure, à celle d'un câble de même diamètre en chanvre d'Italie; cette force sera même supérieure, et cela par une raison très simple, c'est que dans le bois tous les filaments tirent de long et uniformément, tandis que dans le câble, en raison de la torsion, le
850 tirage est inégal et toutes les parties ne travaillent pas.

Cette remarque faite, il s'agissait d'opérer sur le bois—

1°. En choisissant celui qui a les fibres les plus longues et les plus homogènes.

2°. Le soumettre à une macération préparatoire, pour aider au départ du gluten résineux, qui tient les filaments unis entre eux.

3°. Faciliter le départ du gluten par une lessive alcaline à haute pression, concentrée et continue.

4°. Soumettre ensuite ce bois, privé de son lien de cohésion et de sa résine, à l'action de deux séries de laminoirs, dont l'un le divise sur la largeur et l'autre sur l'épaisseur, pour l'amener à un premier état de filasse.

5°. Le lessiver encore une fois dans cet état de filasse, pour le préparer à l'action du blanchiment.

6°. Le blanchir par le chlore gazeux et par la méthode du vide, de manière à ce que, au moyen d'un réservoir de chlore à l'état de gaz, cette opération sont instantanée.

Telle est la série de procédés employés et qui ont donné pour résultat une pâte homogène semblable à celle du coton, parfaitement propre à la fabrication du papier et d'un blanc supérieur.

Le peuplier est le bois qui a rempli les conditions de la manière la plus satisfaisante, en raison de ce qu'il est privé de nœuds; toutefois le sapin, le pin et généralement tous le bois blancs peuvent être employés avec succès.

851 Nous soumettons les plans et coupes des appareils qui nous ont servi dans cette préparation, ainsi que les proportions de chaque substance employée, nous bornant à indiquer ici les procédés au nombre duquel figure celui du blanchiment dans le vide, dont nous attachons la priorité au brevêt réclamé pour la découverte de la nouvelle pâte de papier.

Les avantages de cette découverte sont faciles à comprendre: le chiffon vaut actuellement au minimun 50 fr. les 100 kilogrammes, et fait en moyenne un déchet de 25 pour 100, ce qui le porte à 63 frs. les 100 kilog.

Le bois dont nous nous servons pour le remplacer completément ou en partie vaut, à Paris, 2 frs. le pied cube, et 1 fr. en province; soit à raison de 33 kilog's le pied cube, 6 frs. les 100 kilo's à Paris, et 3 frs. en province.

	Fr.
100 kilo's en moyenne	5
Déchet de 30 pour cent	1. 50
Préparations accessoires autres que celles du chiffon	3. 50
Prix de revient en masse pour 100 kilo's	10. 00

L'avantage remarquable que possède le papier de bois qui nous occupe est de pouvoir être fabriqué à l'épaisseur qu'on désire, et d'être susceptible de recevoir toute espèce d'empreinte en creux comme en relief, comme aussi toute espèce de couleur, ce qui le rend éminemment propre à la teinture et à la décoration des appartements.

852 Lorsqu'on veut fabriquer seule la pâte de bois préparé ainsi qu'il a été dit ci-dessus, afin de donner au' fibre' le lien de cohésion que leur ont enlevé les lessives alcalines et le blanchiment par le vide, il faut incorporer dans la pâte de la résine amenée à l'état de savon; dans le cas contraire, if faut mélanger du chanvre avec la pâte du bois dans la proportion suivie pour le coton.

L'application des couleurs sur le papier de bois et des dessins les plus variés se fait de la manière suivante:

À la suite de la machine à sécher continue sont deux rouleaux, dont le diamètre varie suivant les dessins à exécuter et qui ont pour longueur 1 mètre 50 centim. de table, comme tous ceux de la machine à papier.

Le roleau inférieur est en papier et est destiné à recevoir l'empreinte du supérieur. Ce rouleau se fait très simplement sur un axe tourné, sur lequel on enroule de force et bien tirant une épaisseur donnée de papier

mi-sec. On culle l'extrémité de la feuille; on fait sêcher le tout et on a un rouleau disposé pour servir de matrice.

Le rouleau supérieur est en bois; sur son pourtour sont fixées, avec des clous à vis, les planches de dessin en relief servant à imprimer, et qu'on obtient de la manière suivante:

Sur une surface de bois debout on dessine ou on décalque un dessin donné; on enfonce le trait à un millimètre avec un poinçon; on
853 varlope jusqu'au niveau de l'enfoncement, puis on met le bois varlopé dans l'eau bouillante; au bout de deux heures toutes les parties frappées deviennent en relief sur le rouleau destiné à imprimer; le relief du bois fait sa place dans le rouleau du papier inférieur, et, au moyen d'une distribution d'encre ou de couleur sur le rouleau qui porte les types en relief, on a, à volonté, ou du papier sans fin imprimé ou du papier sans fin ayant toutes les dispositions du coloris et de dessins voulues, le tout presque sans frais.

Ceci, aussi bien que le blanchiment dans le vide, se rattache au brevêt du papier de bois.

On conçoit que les dessins, bien qu'exécutés par un rouleau, peuvent se varier de la même manière que ceux du coton imprimis ou du papier peint frappé à la planche.

On conçoit aussi la facilité de se procurer des ornements en relief sur une surface continue à une ou plusieurs couleurs.

Le papier de bois est éminemment propre à se prêter à ces diverses combinaisons

CARTON DE BITUME.

854 Un emploi susceptible d'une application bien plus étendue est celui du carton de bitume, qui peut servir à la fois à construire des habitations, à les couvrir, à les diviser, à les plafonner, à les carreler, en comportant solidité, durée et élégance.

Avec la faculté de fabriquer du papier de bois de telle épaisseur qu'on le désire et le bas prix de la matière, on fera un carton excellent ayant la raideur de la planche; mais cette raideur ne suffit pas; il faut rendre la substance de ce carton impénétrable à l'eau, unie et susceptible de recevoir toutes les couleurs et tous les dessins.

À cet effet dans la pâte des papiers de bois on mélange, dans la proportion de moitié, du bitume minéral ou goudron de charbon mêlé déjà avec des pierres calcaires pulvérisées et très tenu.

La pâte ayant tous ses filaments accompagnés ou enveloppés de mastic bitumineux, arrivé à l'état de carton sous les cylindres sécheurs, le bitume alors se liquéfie; tout ce qui n'est pas absorbé par l'intérieur vient se concréter à la surface et forme un vernis impénétrable à l'eau, qui remplacera parfaitement l'ardoise et en aura la durée et la couleur, avec une énorme économie de pose première et d'entretien.

855 Ce carton de bitume, préparé à 4 lignes d'épaisseur, fera aussi bien que des dalles, des carrelages, des plafonds d'une seule pièce, sans raccords.

À 6 lignes d'épaisseur, il pourra faire des hangars et habitations provisoires sans autres additions que quatre pieux aux quatre coins pour désigner les angles.

Quant à la pose, rien n'est plus simple.

Par suite de l'affinité du bitume pour le bois, la brique et autres corps, et de son adhérence parfaite, il suffira de chauffer la surface du carton de bitume et de l'appliquer contre la partie à couvrir. Le petit nombre de joints qui auront lieu, vu la grandeur indéfinie des feuilles, seront

raccordés au fer chaud avec une légère addition de bitume si le carton ne présente pas par lui-même ce qu'on nomme vulgairement un joint assez gras.

Ce carton de bitume, dont la surface est glacée et d'une seule couleur, recevra toute espèce de dessin par l'incrustation de sable de diverses nuances.

Pour cette incrustation, il suffit de placer le carton de bitume sur une plaque chaude à une température telle que la surface du carton se liquéfie; alors, avec un moule découpé, et laissant à nu les parties à incruster, on fera toute espèce d'enseignes pour boutique, en
856 lettres de relief et de couleur, ornements de toute nature et de toutes couleurs, s'approchant avec la dernière vérité de ces prodigieuses mosaïques que nous ont léguées les Romains, avec cette différence remarquable, que les mosaïques romaines étaient réservées aux temples et aux palais, tandis que nos mosaïques modernes pourront, dans un temps donné, décorer la dernière maison du dernier village.

857 5 OCTOBRE 1838.

Premier brevêt d'addition et de perfectionnement.

Nous présentons aujourd'hui un appareil à défiler le bois ou à séparer les fibres ligneuses dans le sens de leur longueur pour les rendre propres à la fabrication du papier.

Nous employons le mot défiler parceque c'est une expression consacrée en papeterie et afin que notre appareil ne soit point confondu avec les machines ordinaires servant à effiler le bois de teinture.

Le principe sur lequel nous fondons notre demande actuelle est l'emploi d'un rouleau garni de lames dentées et tournant avec vitesse, contre lequel vient se présenter le bois, dont une quantité donnée est emportée à chaque révolution.

Ce rouleau peut être composé de lames circulaires ou de lames droites.

Le bois se présente sous le rouleau en obéissant à un mouvement de va-et-vient, dans le sens de la longueur, en même temps que le rouleau défileur se rapproche d'une quantité fixée par avance.

DESCRIPTION DE L'APPAREIL.

Pl. 2, fig. 1er, 2e et 3e.

a, rouleau défileur, composé de scies circulaires à larges dents perpendiculaires à l'axe; on peut aussi le composer à lames droites parallèles à l'axe.

b, poulie fixée à l'axe du rouleau *a*, pour lui imprimer une rotation très accélérée.

c d, bras de levier portant le rouleau *a*, et l'abaissant progressivement.

e, bois en bûches soumis à l'action du rouleau *a*.

f g, crémaillère et pignon servant à abaisser le levier *c d* d'une quantité progressive et uniforme.

h i, cadre à coulisse, dans lequel se place le bois à défiler.

k, crémaillère imprimant au bois un mouvement de va-et-vient.
858 *l*, pignon commandant la crémaillère *R*.

m, petit pignon allant et venant sur la crémaillère *n*.

n, crémaillère avec va-et-vient, par l'effet de la bielle *p*, attachée à une excentrique dans la roue *o*.

o, pignon recevant l'action de celui *q*.
p, bielle imprimant un mouvement de va-et-vient.
q, pignon commandé par celui *r*.
r, petit pignon sur l'axe du mouvement principal.
s, poulie de commande pour la machine.
t, poulie qui imprime un mouvement accéléré à celle *b*.
u, rouleau de tension pour la courroie.
v, bâti en bois pour la machine.
x, manivelle pour remonter le rouleau défileur lorsqu'il a terminé la bûche soumise à son action, au moyen du pignon *g*, engrenant sur la crémaillère *f*.

859 16 OCTOBRE 1838.

Deuxième brevêt d'addition et de perfectionnement.

Dans notre brevêt principal, nous nous sommes occupés spécialement de la transformation du bois en papier à l'aide d'une série de préparations qui ont pour but de séparer la partie ligneuse du bois de la partie extractive ou résineuse.

Nous avons dit que pour opérer cette séparation nous commençons par atténuer le bois par l'action de deux machines, dont la première hache et la seconde écrase; que, après cette opération, le bois réduit était immergé dans un bain de chaux vive jusqu'à ce qu'il fut
860 pénétré, puis de là soumis à une lessive caustique sous une pression donnée; qu'enfin, à la suite de ces opérations, la résine étant convertie en un savon soluble à l'eau chaude, les fibres ligneuses du bois restaient à nu.

Dans cet état on pouvait à volonté, ou les faire servir à la fabrication du papier blanc, en les soumettant à un procédé de blanchiment, dont le principe nous appartient et qui sera décrit plus loin, ou les livrer immédiatement aux machines destinées à confection'er, soit le papier, soit le carton ordinaire.

Cette théorie de la transformation du bois en papier est restée toujours la même; mais l'expérience nous à fait apprécier diverses méthodes plus expéditives, soit pour réduire le bois, soit pour activer la solution de la résine qui lie les fibres ligneuses, soit enfin pour reconcréter de nouveau cette résine rendue soluble, après avoir imprimé aux fibres ligneuses, par l'opération mécanique, la forme de papier qu'elles doivent garder.

En un mot, notre étude a été celle-ci :

1°. Détruire la forme primitive du bois en relâchant le lien résineux qui réunit les fibres.

2°. Après avoir donné une forme papier à ces fibres, leur rendre leur lien primitif et leur cohésion en reconcrétant la résine qu'une première opération avait rendue soluble. Nous allons indiquer d'une
861 manière manufacturière la marche que nous avons suivie :

1°. Le bois à l'état sec a été réduit en copeaux par une machine à hacher, pl. 2, fig. 4.

2°. À l'état de copeaux il a été immergé cinq à six jours dans la chaux vive.

3°. Il a été porté sur une machine à battre, fig. 5e, qui l'a réduit à l'état filasse en écrasant les copeaux attendris par la macération dans l'eau de chaux.

4°. Après le battage et l'effilage, il a été mis dans un vase clos avec une eau de potasse rendue caustique par l'addition de la chaux et bouillie à pression pendant 12 heures.

5°. Si on destine cette pâte aux papiers blancs il faut, immédiatement après le lessivage, que la pâte soit lavée à l'eau chaude pour entraîner la résine dissoute, puis de là soumis à un mode de blanchiment dont nous réclamons le privilége comme application même en papeterie.

Ce mode de blanchiment consiste en un courant de chlore gazeux traversant avec pression une lessive de potasse caustique, dans laquelle est immergée la pâte à blanchir.

Par ce procédés il se produit un effet moléculaire que la science seule peut expliquer d'une manière satisfaisante, mais dont l'expérience
862 nous a démontré les résultats incontestables.

En blanchissant par la méthode ordinaire, au chlorure de chaux ou au chlore gazeux seul, il arrive que, pour peu que les fibres ligneuses retiennent encore une portion de résine non-dissoute par l'action de la lessive qui a précédé—il arrive, disons-nous, que le chlore, se trouvant en présence de la résine, cesse d'agir, attendu qu'il n'a nulle action sur ce corps.

Dans notre procédée, au contraire, s'il reste des portions de résine non-dissoutes, la potasse caustique attaque le molécule résineuse adhérante à la fibre ligneuse et la dissout; le chlore alors agit en liberté sur la partie ligneuse mise à nu, jusqu'à ce qu'il se trouve arrêté par la rencontre d'une autre molécule résineuse; c'est alors le tour de la potasse caustique d'agir; et par le concours de ces deux agents favorisés, surtout par la chaleur, on peut atteindre les blancs les plus éclatants.

Nous n'avons pas besoin de nous étendre d'avantage sur la méthode de blanchiment, dont la supériorité peut être facilement constatée.

Ces procédés s'appliquent à la confection du papier blanc.

Lorsqu'il s'agit de papier ou carton d'une couleur brune il est
863 inutile de blanchir, et alors, au lieu de se débar'asser du gluten ou de la résine rendue soluble, on la concrète de nouveau en le précipitant sur la pâte, soit par un sel métallique, soit par l'alun.

Cette opération se fait dans la pile du cylindre ou dans celle du moulin peu de temps avant de livrer la pâte à la machine à fabriquer.

Pour rendre notre papier de bois tout à fait imperméable et éminem'ent propre aux pliages de toute nature, nous lui communiquons un supplément de résine ou de goudron végétal, que nous incorporons à la pâte d'une manière intime et qui rend le papier ou le carton tout à fait imperméable à l'eau.

Là s'arrêtent les procédés ordinaires de fabrication pour le papier de bois et carton bois-bitume; mais, ainsi qu'il a été dit dans notre premier mémoire, là ne sont pas arrêtés nos efforts; nous avons pensé que, à côté d'un produit à bon marché et d'un bon emploi, il y aurait une foule d'applications neuves à faire.

C'est la description des procédés qui ont accomplis ces diverses applications que nous venons donner aujourd'hui d'une manière détaillée, et qui font le motif de la présente demande.

864 COUVERTURE DE MAISONS.

Dans l'état actuel nos toits se couvrent avec des tuiles ou ardoises d'une dimension fort limitée, et qui, par suite, exigent un grand nombre de points d'appui et une dépense de charpente considérable. Dans notre système on pourra économiser moitié du bois de charpente, et faire encore une économie sur le prix de la toiture.

Notre toiture se compose de carton bois-bitume de 2 à 3 lignes d'épaisseur, impénétrables à l'eau, et enduits d'une couche de gravier pour préserver du feu.

Notre méthode pour produire ces cartons ardoises consiste :

1°. À fabriquer du papier très fort et fortement bituminé.

2°. Trois ou quatre feuilles de ce papier sont rapprochées et réunies en un carton solide au moyen de la presse.

3°. Ce carton est induit de deux côtés d'une composition dont on trouvera les éléments dans la première note.

On pose le carton chaud sur une surface plane couverte de gravier de rivière bien sec ; le carton est chargé par le côté opposé, et le gravier s'incruste dans la surface qu'il touche ; le tout, étant sec, présente une surface imperméable et qui réunit la légèreté, l'économie et l'élégance.

865 TUYAUX ET CONDUITS D'EAU, CHENAUX ET VASES DESTINÉS À CONTENIR L'EAU, LE VIN ET SPÉCIALEMENT LES EAUX DE CHLORE OU ACIDULÉES, QUI SONT SANS ACTION SUR LE BITUME.

Pour confectionner les tuyaux et conduits d'eau, on a un madrin tourné, sur lequel on roule le carton bois au diamètre du tuyau demandé ; on rapproche les bouts jusqu'à ce qu'ils se touchent sans faire de surépaisseur ; alors, de distance en distance, soit de 25 en 25 centimètres, on lie le tuyau avec un fil de fer, pour que les bouts restent rapprochés ; on tire le madrin ; on plonge le tuyau dans la composition décrite au premier article, on le promène dans cette composition jusqu'à ce qu'il soit garni à l'intérieur et à l'extérieur ; puis, on le place chaud sur une table couverte de gravier également chaud, sur lequel on le roule jusqu'à ce que la surface extérieure soit bien garnie.

De la même manière on fera toute espèce de vases propres à renfermer l'eau, le vin et les eaux de chlore ou acidulées.

On peut faire de même les sceaux pour incendie, les réservoirs d'eau, les éviers, les tuyaux d'égout, les gouttières et généralement tout ce qui est destiné à renfermer des liquides.

De vieux tonneaux enduits de notre composition sont aussi impénétrables que des tonneaux neufs et peuvent être appliqués, non seulement au vin, mais encore au chlorure liquide et aux eaux acidulées.

866 DOUBLAGE DES NAVIRES.

C'est ici le cas de dire qu'aucune substance végétale ne peut faire un emploi meilleur que notre carton bois-bituminé placé entre le cuivre et le bois, ou appliqué seulement sur le bois sans addition de cuivre ; on conçoit toute la durée que doit acquérir le bois mis entre deux surfaces impénétrables à l'eau de mer.

Quant à la préparation, elle consiste à donner au carton un enduit tel qu'il sort à la fois souple et imperméable ; c'est à quoi on arrive par la composition décrite dans le second article.

Ce doublage pouvant s'établir par grandes zones d'une longeur illimitée sur 1 mètre 50 de largeur aurait l'avantage de présenter fort peu de joints.

Nous avons de bonnes raisons pour penser que notre doublage suppléerait tout à fait à l'emploi du cuivre que l'eau de mer oxyde et détruit assez promptement, tandis qu'elle est sans action sur le carton bitume.

FLOOR-CLOTH, OU MOSAÏQUE', POUR APPARTEMENTS.

Bien que l'habitude du comfortable *floor-cloth* ne soit pas encore générale en France, il est permi d'espérer qu'on y viendra lorsque le

carton bitume pourra remplir cette lacune avec une économie remarquable.

Notre procédé de fabrication consiste à colorer des graviers de rivière bien lavés dans toutes les nuances, au moyen de dissolutions métalliques.

867 Ce gravier bien sec est disposé sur une table parfaitement plate, et on en forme tel dessin que bon semble en le promenant sur une surface polie et horizontale au moyen d'un moule à jour; le dessin étant disposé, on le roule pour lui donner partout une épaisseur égale.

Alors on prend des cartons revêtus de la composition No. I; on les place sur le sable en appuyant uniformément sur le côté opposé; le sable chaud s'incruste, et présente, en mosaïque, le dessin formé sur la table nue.

Lorsque le tout est sec, cela forme un corps solide représentant avec une immense économie la mosaïque la plus compliquée de nuances et de dessin.

Ce carton mosaïque s'applique aux vestibules intérieures et extérieures, aux salles de bain, aux salles à manger, aux tables, et partout où l'on veut une surface susceptible d'être épongée et lavée.

ENSEIGNES ET AFFICHES PERMANENTES.

Le même procédé s'applique aussi, avec une immense économie, aux enseignes et affiches permanentes, en faisant des incrustations de lettres en pierres brillantes ou de couleurs.

Cet emploi a cela de remarquable, c'est qu'il réunit une immense économie à une durée indéfinie, car l'air et la pluie sont sans action sur le carton-bitume; et, par suite, les enseignes resteront ce qu'on les fait pendant une longue période de temps.

868 Nous nous sommes servis avec avantage pour former nos lettres de quartz brillant, qui rend très bien sur le noir.

Composition No. I.

Brai minéral	50	parties.
Gypse tamisé	25	"
Manganèse péroxydé	20	"
Brai végétal élastique	5	"
	100	

Composition No. II.

Brai minéral	50	parties.
" végétal	15	"
Talc en poudre	28	"
Manganèse d'Allemagne	5	"
Cire jaune	2	"
	100	"

869 EXHIBIT No. 31.—R. E. STILWELL, *Examiner, &c.*

No. 9215. Paris, Feb'r. 7, 1838. Montgolfier frère. Translation.

No. 9215. *Paris, February 7*, 1838. *Montgolfier frères.—Patent for ten years, dated February 7*, 1838, *for the manufacture of paper from wood, as well as pasteborad from bituminous* [bituminized] *wood.*

All the fibrous substances are more or less adapted to enter as constituents of paper-pulp, which may be compared to an ordinary tissue, with the only difference as to the mode of cohesion of the threads *and* [or] fibrous portions.

Thus among the number of these substances, the following may be classed in the first rank:

1. *Linen*, [flax.]
2. Hemp.
3. Cotton.
4. The nettle and other plants analogous to hemp.
5. Straw, hay, clover, buckwheat, maize.
6. The leaves of various trees.

The processes of working these various substances are published. Numberless experiments have been made at various times, resulting, generally, in the return to the use of hemp and cotton, as affording a product the most advantageous, both as to quality and quantity.

All the other substances which we have just mentioned have also one of the following objections: Either from their rarity and consequent high price, [or as] occasioning a loss too considerable to admit its being made into paper, or lastly, on account of their producing a paper of bad quality, and much inferior to that of hemp or cotton.

But if all these substances are respectively examined, it will be the more obvious that they contain but a small quantity of fibrous matter, compared with their weight and cost, and consequently it is an expensive policy to abandon rags in order to return to a fictitious substitute.

From *the* [this] consideration on the one side and the examina-
870 tion made on the other, that the strength which a piece of wood of a long fibre gives, compared with that of a hemp rope, we are induced to believe that in the wood, as well as in the hemp-rope, there must exist a junction of the threads or fibres, more or less analogous to that of hemp, but that divided they must offer a resistance proportional to that of *the* [a piece] wood and a hemp-rope of the same diameter.

Now, from experiment, a billet of pine, poplar, or a wood of long fibres, of one inch in diameter, presents a [tensile] strength equal if not superior to a rope of Italian hemp of the same diameter, and that, from a cause perfectly simple, which is, that in wood all the fibres are laid lengthways and uniformly, while in rope, on account of *its torsion*, [the twist in it] the strain is unequal, and every portion is not brought into play.

This remark being made, it is necessary, in operating on wood,

1st. To choose that kind which possesses the longest and most homogeneous fibre.

2d. To expose to a preparatory maceration in order to assist in the removal of resinous gluten, which connects the fibres together.

3d. To aid the removal of the gluten by a [concentrated and lasting] alkaline *bath*, [lye] for a considerable time, under high pressure.

4th. Then submitting *the* [this] wood deprived of cohesive mediu*m*

or of its resin, to the action of two series of rollers, of which the one divides it along its length, and the other across its thickness, to bring it to the first *fibrous* [filamentary] state.

5th. The treating with alkali a second time in fibrous state to prepare it for bleaching.

6th. This bleaching by chlorine in a gaseous state by a vacuum *progress*, [process] operated by a means of a reservoir of chlorine in the state of gas. This operation may be instantaneous.

Such is the series of operations employed, and which have afforded, [as a result,] a homogeneous pulp resembling that of cotton perfectly fitted for the manufacture of paper, and of a superior white color.

871 The Lombardy poplar is the wood which fulfills the conditions the most satisfactorily, for the reason that it is free from knots. Nevertheless the fir, pine, and, in general, all the white woods, may be successfully employed.

We give the plans and sections of the apparatus which we have used in this manufacture, as well as the proportions of each material employed. We refrain *from showing here the process relating to bleaching in vacuo, to which we attach a secret patent, claimed for the discovery of this new paper-pulp*, [indicating here the processes of which bleaching in vacuo makes one, and for which we claim priority in a patent based upon a claim for the discovery of a new paper-pulp.]

The advantages of this discovery are easily understood. The minimum actual cost of rags is fifty francs per one hundred kilogrammes, but the average loss is twenty-five per centum, which brings it to sixty-three francs the one hundred kilogrammes.

The wood which we use to partially or wholly replace rags, costs, in Paris, two francs the cubic foot, and one franc in the country; in the proportion of thirty-three kilogrammes to the cubic foot, six francs the one hundred kilogrammes in Paris, and three francs in the country.

100 kilogrammes on an average,	5.00 francs.
Loss of 30 per cent.....	1.50
Cost of manufacturing, over and above that of rags.....	3.50
Cost.....	10 francs for 100 kilogrammes.

The particular advantage which the wood-paper we employ possesses is its capability of being made of any desired thickness, and its susceptibility of receiving every kind of printing, either sunk or in relief, as well as of every kind of colors, which renders it eminently adapted for *painting on*, [tinting or dying] and for the decoration of apartments.

When it is only intended to make a *paper* [pulp] prepared as we have stated above, in order to give the fibres the cohesive property, which the alkaline bath and the vacuum bleach has removed, it is necessary to incorporate in the pulp some resin, *used in* [brought to] the state of soap, otherwise it is necessary to mix some hemp with the wood-pulp in the proportion used for cotton.

872 The application of colors on wood-paper and of the most varied designs is done in the following manner:

In the continuation [at the end] of the *continual* [continuous] drying-machine are two rollers, the diameter of which varies according to the design executed, and which are one meter and fifty centimeters in

length, as all those tables for paper-machines. The lower roller is of paper, and is designed to receive the *printing from*, [impress of] the upper. *The* [this] roller is made very simply on a *turning* [turned] axis on which is firmly rolled a given thickness of *dry* [damp] paper. The end of the sheet is glued down, the whole is dried, and there is produced a roller ready to serve as counter-roller. The upper roller is of wood. On its outer surface are fastened with wood-screws the design-plates in relief serving to print, and which are obtained in the following manner: On a surface of wood, grain upwards, is designed or transferred a given design. The drawing is driven in about a milli-
873 meter with a punch. The surface is planed off down to the level of the punch-marks, then the wood so planed is put in boiling-water. At the end of two hours all the parts *struck* [driven down] come out in relief on the roller designed to print. The relief of the wood makes its *die* [impression] in the lower paper-roller, and by means of the distributing ink or color on the rollers which carry the type in relief, it is at the will of the operator to have on the [endless] paper all the disposition of colors and design wished; all this being nearly without cost. This as well as the bleaching in a vacuum attaches itself to the patent for wood-paper. It is seen that the designs executed by a roller can be varied in the same manner as those of the cotton-printing, or the paper-hangings struck by *plates* [blocks.] It will also be seen with what facility ornaments in relief or a continual surface in one or more colors can be procured. The wood-paper is extremely fitted to be used for these different combinations.

874 BITUMINOUS PASTEBOARD.

Another convenient use for an application yet more extensive, [a use susceptible of more extended application,] is that of bituminous pasteboard, which can serve at the same time to construct dwellings, or to cover them, to divide them, to form ceilings or floors, possessing at the same time qualities of solidity, durability, and elegance. Being able to manufacture wood-paper of any thickness as desired, and the material being cheap, an excellent pasteboard, having the stiffness of wooden boards can be made; but this stiffness is not sufficient. It is necessary to make the substance of this pasteboard impermeable to water, smooth, and susceptible to receive all kinds of colors and designs. For this purpose is mixed with the wooden paper pulp, in the proportion of one-half, mineral bitumenor coal tar mixed with pulverized and well-reduced limestone. The pulp having all its fibres compounded or surrounded with bituminous mastic arriving in the state of pasteboard on the *the* drying-cylinders the bitumen now becomes liquified, and all that is not absorbed in the interior comes to the surface & harden' 875 and form' a varnish impermeable to water. This material replaces perfectly the slate, and has the durability and color of the same, with a great saving of labor in laying it down at first and in repairing.

This bituminous pasteboard, made about four lines thickness, will also be good for pavements and for ceilings in a single piece without prints. When six lines in thickness it can be used for shanties and temporary buildings without any other additions than four posts in the four corners to designate the angles. The laying down of it is very simple by reason of the affinity of bitumen for wood, bricks, and other bodies, and on account of its perfect adherence, it will be sufficient to heat the surfaces of the bituminous pasteboard and to apply them to

the parts to be covered. The small number of joints which are made, considering the indefinite *length* [size] of the leaves, can be joined by a hot iron and a small addition of bitumen, if the pasteboard itself forms not what is commonly called a joint good enough.

876 The bituminous pasteboard, the surface of which is glossy and of only one color, receives all kinds of designs by incrustations of sand of different colors. For this incrustation it is sufficient to place the bituminous pasteboard on a hot plate of such a temperature that the surface of the pasteboard liquifies. Now with a mould cut out and showing only the parts to be incrusted, all kinds of signs for stores, letters in relief, and colored ornaments of all kinds and all colors can be made, approaching closely to the prodigious mosaics which have been left us by the Romans, with this remarkable difference, that the Roman mosaics were to serve in temples and palaces while our modern mosaics can be used in any given time to decorate even the last house of the last village.

877 *First patent of addition and improvements, Oct'b'r 5th*, 1838.

MONTGOLFIER FRÈRE.

We present to-day an apparatus to reduce the wood, or to seperate the ligneous fibres in the direction of their length, for to make it adaptable to the manufacture of paper.

We us' the word reduce (défiler) because it is a technical term in paper manufacture, and that our machine be not mixed up with the common *log* [dye] wood chopping-machines.

The principle on which we found our present demand is the use of a roller arranged with toothed saws and turning with speed, against which is presented the wood, a given quantity of which is *carried off* [removed] at each revolution.

This roller can be composed of circular-saws, or straight-saws. The wood is placed under the roller and has a to and fro movement in the direction of its length at the same time that the *cutter* [rasping-roller] approaches a certain amount forward.

DESCRIPTION OF THE APPARATUS.

Plate 2, Fig's I, II, and III.

a. The cutting-roller, is composed of circular saws with large teeth *vertical* [perpendicular] to the axis. It can also be composed of horizontal straight-saws parallel with the axis.

878 *b.* Pulley fixed on the axis of *of* the cylinder *a*, to give it a very high velocity.

c d. Lever arms carrying the cutting-cylinder *a*, & lowering this gradually.

e. Block of wood submitted to the action of the cutting-cylinder *a*.

f g. Rack and pinion serving to lower the levers *c d*, a certain uniform distance.

h i. Sliding frame in which is placed the wood to be cut up.

k. Rack giving to the wood a motion to and fro.

l. Pinion *to go in* [acting upon] the rack *k*.

m. Small pinion passing to and fro on the rack *n*.

n. Rack with a to and fro motion by the action of connecting-rod *p*, attached to an eccentric on the wheel *o*.

o. Pinion receiving its motion from *q*.

p. Connecting-rod giving a to and fro motion.

q. Pinion in gear with *r*.
r. Small pinion on the main driving-axle.
s. Driving-pulley of the machine.
t. Pulley which gives an accelerated motion to *b*.
879 *u*. Tension-roller for the belt.
v. Wooden frame of the machine.
x. Shaft to lift the cutting-cylinder when it is done with the block of wood submitted to its action by means of a pinion *q*, gearing into the rack *f*.

880 *Second patent of additions and improvements, October* 16, 1838.
Montgolfier freres.

In our principal patent we are chiefly engaged in the conversion of wood into paper, by means of a series of processes designed to separate ligneous from the extractive or resinous parts of wood.

We have said that, for effecting this separation, we commence by reducing the wood by the action of two machines, of which the first chops it, and the second crushes it; that, after this operation, the reduced wood was placed in a [quick] lime-bath until it was saturated, then submitted to a caustic alkaline solution, under a given pressure; that, finally, at the end of these operations, the resin was converted into a soap soluble in hot water, the ligneous fibres of the wood remaining bare.

In this state they can, if desired, be employed in the manufacture of white paper by submitting them to a bleaching-process, the principle of which belongs to us, and which will be described further on; they may then be at once passed to the machine necessary to convert them either into ordinary paper or card-board. This theory of the conversion of wood into paper always remains the same, but our experience has taught us divers modes more expeditious, both in the reduction of the wood, and hastening the solution of the resin which binds the ligneous fibres, or, lastly, for the recementing again of this soluble resin, after having given, by mechanical means, to the ligneous fibres the form of paper *for the purpose of protecting them*, [which it is to remain in.]

In one word, our endeavor has been this:

First. To destroy the primitive form of the wood by loosening the resinous connections which bind the fibres.

Second. After having given the form of paper to the fibres, to return them their original cement and cohesion, by *refixing* [resolidifying] the resin which was rendered soluble by a previous operation.

881 We will now describe the process of manufacture which we have followed:

First. The dry wood has been reduced to chips by the chopping-machine, Plan 2, Figure 4.

Second. When in the state of chips, it has been immersed for five or six days in quick-lime.

Third. It has been brought into a beating-machine, [Fig. 5] which has reduced it to a fibrous state by crushing the chips softened by their maceration in lime-water.

Fourth. After the beating or opening out, it has been placed in a close vessel with a solution of *caustic potash*, [potash rendered caustic by the addition of lime,] and boiled under pressure for twelve hours.

Fifth. If this pulp is destined for white paper, it is necessary that, immediately after alkaline treatment, the pulp should be washed in hot water to remove the dissolved resin, then submitted to a bleaching-process, of which we claim the right for application in paper-making.

This mode of bleaching consists in passing a stream of chlorine gas under pressure into a solution of caustic potash, in which the pulp to be bleached is immersed. By this process a particular effect is produced, which science alone can explain in a satisfactory manner, but which practically has afforded us incontestable results. In bleaching by the ordinary method, by chloride of lime or chlorine gas alone, it happens that if the ligneous fibres retain but ever so little resin undissolved by the previous alkaline action, that the chlorine brought into the presence of resin ceases to act, and *to remain without effect* [and has no action] on the substance.

In our process, however, if portions of the resin remain undissolved, the caustic potash attacks the resinous molecule adhering to the woody-fibre and *dissolving it* [dissolves.] The chlorine then freely acts on the woody part laid bare, until it is arrested by meeting with another resinous molecule. It is then the turn of the caustic potash to act. By the mutual aid of these two great agents, specially aided by heat, we can obtain the most *perfect* [brilliant] white.

It is not worth while to expatiate more on this mode of bleaching, the superiority of which may easily be proved.

These processes are applicable to the manufacture of white paper. When a brown paper or card-board is to be made it is useless to bleach it; then, instead of removing the soluble gluten or resin, it is again concreted and precipitated in the pulp by means of a metallic salt or by alum.

882 This operation is done in the cylinder-machine or in the mill shortly before the pulp is delivered to the paper-making machine. To make our wood-paper entirely impermeable and *highly able to be bent in every direction*, [serving for all wrapping purposes,] we give it an addition of rosin or vegetable tar, which we thoroughly incorporate with the pulp, which makes the pasteboard completely impermeable to water.

Here end the general proceedings of the manufacture of wood-paper and bituminous wood pasteboard. But, as has been said in our first description here, our efforts have not ended. We have thought that besides a [cheap] product *of good sale* and *of good use*, [also useful,] quite a number of new uses or applications can be made of it. It is the description of the processes which have accomplished these different results which we will give to-day in a detailed manner, and which form the motive of the present demand.

883 ROOFING FOR HOUSES.

At the present time our roofs are covered with tiles or slates of a dimension very limited, and which, therefore, require a great number of supporting-points and a considerable expense for carpenter work. In our system there could be saved half of the wood necessary, and make yet an economy in the price of the roofing. Our roofing is composed of a bituminous-wood pasteboard from two to three lines thickness, impermeable to water, and imbedded with a layer of gravel to preserve it from fire.

Our method of producing slate-pasteboard consists—

1st. In manufacturing very strong and highly bituminized paper.

2nd. Three or four leaves or sheets of this paper are brought together and united in a solid pasteboard by means of a press.

3d. The pasteboard is saturated from the two sides by a composition, the elements of which are found below in the first note.

884 The hot board or pasteboard is placed on a plane surface, covered

with river-gravel, well dried. The pasteboard is charged from the opposite side, and the gravel incrusts into the surface which it touches. All this presents, when dry, an impermeable surface, which unites lightness, economy, and elegance.

TUBES, WATER-PIPES, TROUGHS, AND VESSELS DESIGNED TO HOLD WATER, WINE, AND ESPECIALLY CHLORINE, OR ACIDULOUS WATERS, WHICH DO NOT ACT ON THE BITUMEN.

To manufacture tubes or water-pipes, a turned mandrel of the diameter of the tube desired is necessary, on which is rolled the wooden pasteboard. The ends are brought together until they touch without lapping. Now, at short distances apart, say from twenty-*five* to twenty-five centimeters, the tube is tied with an iron wire, so that the ends remain close together. The mandrel is withdrawn. The tube is plunged in the composition described in the first note. It is moved in this
885 [com]position until it becomes covered on the interior as well as the exterior. Then, while it is yet hot, it is placed on a table covered with gravel, also hot, on which it is rolled until the outer surface is well covered. In the same manner all kinds of vessels proper or fit to enclose water, wine, and chlorine or acidulous waters, are made. In the same manner fire-buckets, water-reservoirs, sinks, water-pipes and gutters, and generally all that is designed to enclose liquids, can be made. Old casks soaked in our composition will also be made as impermeable as new casks, and can be employed not only for wine but also for chlorine and acidulous liquids.

SHEATHING OF VESSELS.

It is necessary here to say that no other vegetable substances can be better used than our bituminous-wood [pasteboard,] placed be-
886 tween [the] copper and the wood, or applied alone to the wood without the addition of copper. It is readily understood how long wood placed between two surfaces impermeable to sea-water will last. The preparation consists in giving to pasteboard a soaking, so that it be at the same time flexible and impermeable. This result is obtained by the composition described in the second article. The sheathing being applied in great zones of almost unlimited length of one meter and fifty centimeter width, would have the advantage of presenting very few joints. We have good reasons to believe that our sheathing would perfectly replace the use of copper, which the sea-water oxidizes, and very soon destroys, while it has no action on the bituminous paper.

FLOOR-CLOTH OR MOSAICS FOR ROOMS.

Although the custom of using [com]fortable floor-cloth is not generally introduced in France, it is permitted to hope that we will
887 arrive at that state when the bituminous paper will supply this want with considerable saving. Our process of manufacture consists in coloring river-gravel, well washed, with all kinds of shades, by means of metallic solutions. This gravel is well dried, and placed on a table perfectly flat, and such designs [as appear handsome] are formed *of good looks* by *walking* them on a polished and horizontal face by means of a vibrating mill. The design having arranged itself, roll it over to give it everywhere an even thickness. Now the pasteboard, covered with the composition No. I, is taken and placed on the *table* [sand] and

pressed uniformly *over the proper* [on the opposite] side. The hot sand will incrust and show in mosaic the design formed on the plain table. When all is dry this forms a solid body, representing, with a great saving, a mosaic most complicated in colors and design.

The mosaic pasteboard can be applied to interior vestibules
888 and to the exterior, to bathing-halls and eating-halls, [to tables,] and wherever a surface susceptible of being sponged and washed is desired.

SIGNS AND [PERMANENT] POSTERS.

The same process is also applicable with great economy to permanent signs and posters in making the incrustations of letters in brilliant or colored stones. This use is remarkable in that it combines immense economy with an indefinite durability; for the air and rain have no effect on the bituminous pasteboard, and, therefore, the signs will be the same during a long period of time. We have used, with advantage, for making our letters, brilliant quartz, which shows well on the black.

COMPOSITION NO. I.

	Residuum of mineral coal-tar, [coal-tar]	50 parts.
889	*Green* [ground] gypsum	25 parts.
	Peroxyd of manganese	20 "
	Flexible vegetable resin	5 "
		100 "

COMPOSITION NO. II.

Mineral residuum of coal-tar [coal-tar]	50 parts.
Vegetable resin	15 "
Powdered talc	28 "
German manganese	5 "
Yellow wax	2 "
	100 "

EXHIBIT No. 32.—R. E. STILWELL, *Examiner, &c.*

4566. 12 mai 1838. Mr. Wise, (Charles.) Paris. Copie, (French).

(Here follows diagram, marked page 890.)

[Brevêts d'invention, 1st series, vol. 43, pages 37, 38, 39, & 40, and plate, printed, the year not given.]

890 12 mai 1838.

Brevêt d'invention de 15 ans, déchu par ordinnance du roi du 1 er, jan. 1841, au sieur Wise, (Charles,) à Paris, Pour un appareil perfectionné pour le lessivage et le blanchiment des chiffons et autres matières employées dans la fabrication du papier, lequel appareil peut aussi recevoir d'autres applications.

INTRODUCTION.

Le principe sur lequel repose l'invention dont s'agit consiste à maintenir constamment en mouvement les matières sur lesquelles on agit, et à les soumettre à une grande chaleur, qui est entretenue pendant

tout le cours de l'opération. Comme le mouvement nécessaire peut être imprimé de plusieurs manières, l'appareil que j'ai inventé peut subir diverses modifications qui atteindraient plus ou moins avantageusement le but que je me suis proposé ; il suffra, néanmoins, de décrire les deux appareils qui m'ont parfaitement réussi dans mes expérimentations, et qui offrent l'application du principe ci-dessus posé : un de ces appareils est chauffé par la vapeur fournie par un générateur ; le second appareil est posé sur un fourneau, et produit ainsi la vapeur nécessaire.

Premier appareil—dessins.

Pl. 3e, fig. 1ere, coupe verticale, prise longitudinalement du premier des appareils.

Fig. 2e, coupe verticale du même, prise transversalement.

891 Fig. 3e, vue, par un bout, du dit appareil. Les mêmes lettres indiquent les mêmes parties dans toutes les figures.

Description.

a a, cylindre creux, semblable à un générateur. Il est fait en fer, cuivre ou autre métal approprié, et doit être d'une dimension convenable.

b b', axe creux dans toute sa longueur, ou dans une partie seulement, sur lequel est fixé le cylindre *a a ;* cet axe tourne dans des coussinets placés dans un bâti en la manière ordinaire ; ni les coussinets ni le bâti n'ont été representés parcequ'ils n'offrent rien de particulier ; cet axe, par l'extrémité b', reçoit la vapeur provenant d'un générateur, et com e il est percé de petits trous dans toute la partie enfermée dans le cylindre il livre ainsi passage à la vapeur pour se rendre dans le dit cylindre. Une boîte à étoupes est disposée en la manière ordinaire pour l'introduction de la vapeur en *b'*.

c c, grille en fer, divisant la chaudière longitudinalement en deux parties égales. On peut, au lieu d'une grille, employer une cloison en métal ou autre matière percée d'un grand nombre de trous. La grille, *c c*, a un mouvement partiel sur l'axe *b b'*, ainsi qu'on le voit dans la fig'e 2e, où *c c* indiquent une des positions de la grille, et *c' c'*, l'autre position ; ces mouvements égalent en étendue l'ouverture du cylindre et sont limités par quatre arrêts, *d d d d*.

892 *e*, engrenage, monté sur l'extrémité de l'axe *b b'*, et mis en mouvement par la manivelle et le pignon *f*. On pourrait remplacer l'engrenage et la manivelle *f* par une poulie menée par une courroie, relevant le mouvement d'une machine à vapeur ou de tout autre moteur employé.

g g g, trous d'homme, pour l'introduction et l'extraction des matières sur lesquelles on opère ; ces trous sont fermés par des couvercles, qui ne laissent aucune issue au liquide ni à la vapeur.

h, tuyau, pour l'écoulement du liquide employé, soit pour le lessivage, soit pour le lavage.

Opération.

On introduit par les trous d'homme *g g g* les matières qu'on veut lessiver dans le cylindre *a*, et par moitié dans chacune des divisions formées par la grille ou cloison *c c ;* on verse dans le cylindre une quantité suffisante de lessive ou de liqueur alkaline, pour couvrir l'axe creux *b b' ;* on introduit alors la vapeur dans le cylindre ; enfin on met en action la manivelle.

Le cylindre tourne sur l'axe *b' b*, comme sur deux tourillons, et les matières sur lesquelles on opère sont constam'ent traversées par la lessive, qui, par son proper poids, retombe dans le bas du cylindre.

On pourrait faire tremper préalablement les chiffons dans une forte lessive et les introduire dans l'appareil. Il suffirait alors de lais-
893 ser pénétrer la vapeur dans le cylindre, et le reste de l'opération aurait lieu comme ci-dessus.

Quand le lessivage est terminé on soutire la lessive par le robinet *h ;* on verse une eau pure dans la cylindre ; on continue l'agitation pendant quelques minutes ; on laisse couler l'eau, et on retire les matières parfaitement lessivées et préparées pour subir l'opération du blanchiment au moyen des acides en la manière ordinaire.

Observations.

On sent qu'on pourrait modifier l'appareil ci-dessus décrit en plaçant deux ou plusieurs grilles dans l'intérieur du cylindre *a a* qui se trouverait ainsi divisé en quatre capacités ou en un plus grand nombre ; on pourrait laisser le cylindre immobile et faire seulement tourner la grille *c c*, qui ferait ainsi successivement passer les matières à travers le bain alcalin ; ou bien, si l'on préfer'ait faire mouvoir le cylindre, on pourrait lui imprimer un mouvement d'oscillation.

On pourrait encore faire tourner le cylindre sur son axe transversal, au lieu de le fair' tourner sur son axe longitudinale ; la grille alors subirait les modifications nécessaires.

Toutes ces dispositions ne seraient que des modifications apportées à l'appareil présentement décrit et offriraient le dévelop'ement du même principe.

Second appareil—dessins.

Fig. 4e, coupe verticale, prise à travers l'appareil de son four-
neau.

894 Fig. 5e, coupe longitudinale du même appareil isolé de son four-
neau.

Les mêmes lettres indiquent les mêmes parties dans ces deux figures.

i i, massif du fourneau.

j j, grille supportant le combustible.

l, cendrier.

m m, carneaux, dans lesquels circule la flamme.

n n, chaudière cylindrique, ou de toute autre forme appropriée, ayant un couvercle, *o o*, d'une dimension suffisante pour permettre l'introduction d'un cylindre intérieur, ainsi qu'il sera dit ; le cylindre étant introduit, on assujettit le couvercle, qui doit opérer une fermeture hermétique.

p p, cylindre supporté par deux tourrillons, qui traversent la chaudière *n n*, et par deux boîtes à étoupes non représenté's dans le dessin, lesquel's boîtes empêchent que la vapeur ne s'échappe. Le cylindre *p* se compose d'une carcas'e, sur laquelle sont fixées des bandes ou lames de métal ayant les unes des pointes, *r r*, de 3 pouces de sailleé, et les autres des trous d'une demi-ligne de diamètre. Ces lames sont placé's alternativement sur la carcasse à une distance de 2 lignes les unes des autres.

s s, tourrillonis du cylindres, sur lesquels il tourne ; sur l'un de ces tourrillons est adapté un engrenage, avec manivelle semblable a celui *e f*, represenié fig. 1er, pour le 1e' appareil.

t t, ouverture pratiquée dans le cylindre et d'une dimension
895 convenable pour l'introduction des matières sur lesquel's on veut opérer.

FONCTIONS DE L'APPAREIL.

Le cylindre *p p*, ayant été mis en place, on y introduit les matières sur lesquel's on opère; on ferme alors le couvercle *t t*, qui n'a pas besion de clore hermétiquement. On verse une quantité convenable de lessive dans la chaudière *n*, par l'ouverture *o o*, que l'on referme hermétiquement; on allume le feu dans le fourneau, et on met en mouvement le cylindre.

Le liqueur alkalin pénètre dans le cylindre par les trous dont il est percé et abreuve les matières qu'il renferme; ces matières sont constamment ramassies par les pointes *r r*, et circule' ainsi à travers la lessive bouillante, ce qui les purifie rapidement et les prépare pour l'opération du blanchiment au moyen d'acides.

Quand la purification est opérée, on soutire la lessive; on intercepte la flamme; on introduit une eau pure, pour opérer le rinçage; le cylindre étant mis en mouvement, comme il a été dit, on soutire cette eau et l'opération est terminée.

Les mêmes observations rélativement aux modifications qu'on pourrait apporter au premier appareil s'appliquent également au second sous le rapport, tant de la forme de l'appareil que de la manière de donner au dit appareil l'impulsion nécessaire.

Ce système de lessivage et de préparation pourrait être aussi ap-
896 pliqué au fils et étoffes de coton, de lin, de chanvre et toute autres matières qui ont besoin d'etre soumises à cette opération; dans ce cas, on donnerait naturellement la préférénce au premier des appareils, en ce que les pointes du second pourraient nuire au fils et aux tissus.

897 EXHIBIT No. 33.—R. E. STILWELL, *Examiner, &c.*

4566. May 12th, 1838. Mr. Wise, (Charles,) Paris. Translation.

[Brevêt d'invention, vol. xliii, (old series,) p. 37, 4566, May 12, 1838.]

(Patent for fifteen years, forfeited by the orderof the king, January 1, 1841.*)*
To M. Wise, (Charles,) of Paris. For an improved apparatus for treating with lye and bleaching rags and other materials used in making paper, which apparatus can also be adapted to other uses.

INTRODUCTION.

The principle upon which the above-named invention rests, consists in keeping the materials to be treated in constant motion, and in subjecting them to a great heat, which is kept up during the entire operation.

As the necessary movement can be communicated in various ways, so the apparatus that I have invented can undergo various modifications, which may attain more or less advantageously the result which I have proposed.

898 FIRST APPARATUS AND DRAWINGS.

Plate 3. Figure 1 is a vertical longitudinal section of the first apparatus.

Figure 2 is a vertical transverse section of the same.
Figure 3 is an end view of the said apparatus.
Similar letters indicate the same parts in the different figures.

DESCRIPTION.

a a is a hollow cylinder similar to a steam-boiler. It is made of iron, copper, or other suitable metal, and must be of suitable dimensions.

b b^1 is an axis, hollow either throughout its whole length or in one part only, on which is fastened the cylinder *a a*. This shaft turns in bearings placed in the frame in the usual way. Neither the bearings nor the frame are represented, because they are in nowise peculiar. This shaft receives from the end b^2 [b^1] steam coming from a steam-boiler,
899 and having little holes drilled all around the part enclosed in the cylinder, it furnishes a passage for the steam into the cylinder. A stuffing-box is arranged in the usual manner to admit the steam into b^1.

c c is an iron grating dividing the boiler longitudinally into two equal parts. Instead of this grating a partition of metal or other material punched with a number of holes may be used. The grating *c c* has a partial revolution on the shaft *b* b^1, as is seen in Figure 2, where *c c* indicates one position of the grate and c^1 c^1 another position. This movement is equal to the extent of the opening of the cylinder, and is limited by four stops *d d d d*.

e is a gear-wheel mounted on the end of the shaft *b* b^1, and set in motion by the crank and pinion *f*. The gear-wheel *e* and crank *f* might be replaced by a pulley driven by a belt receiving its motion from a steam-engine, or any other motor used.

900 *g g g* are man-holes for the introduction and extraction of the material which is to be operated upon. These holes are closed by covers which are steam and water tight.

h is a tube for conducting off the liquid which has been used either in treating the material with ley or in washing the same.

901 OPERATION.

The material to be treated is introduced into the cylinder *a* through the man-holes *g g g*, and half placed in each one of the divisions formed by the grate or partition *c c*. A sufficient quantity of lye or alkaline liquor is poured into the cylinder to cover the hollow axis *b b*; then the steam is introduced into the cylinder, and finally the crank put in motion. The cylinder turns upon the axis *b b*, just as upon two trun'ions, and the materials under treatment are constantly penetrated by the lye, which, by its own weight falls back again to the bottom of the cylinder.

The rags can be previously soaked in a very strong lye, and then introduced into the apparatus; it will then only be necessary to let the steam enter into the cylinder, and the rest of the operation will go on as above cited.

When the treating with lye is finished, the liquor is drawn off through the cock *h*, and pure water is turned into the cylinder; the motion of the crank is kept up for some minutes; the water is drawn off, and the material removed perfectly treated with lye and ready to endergo the operation of bleaching with acids after ordinary methods.

OBSERVATIONS.

It is perfectly evident that the apparatus above described can be modified by placing two or more grates in the interior of the cylinder

a a, which will be thus divided into four receptacles, or even a greater number.

The cylinder can remain fixed and only the grate be made to turn, which would thus successively pass the materials through the alkaline bath, or rather, if one should prefer to move the cylinder an oscillatory motion could be given to it.

Still farther, the cylinder could be made to turn upon its transverse axis instead of upon its longitudinal. The grate would then receive the modifications necessary for this arrangement.

These various arrangements would only be modifications belonging to the apparatus now described, and would be but a development of the same principle.

SECOND APPARATUS.—DRAWINGS.

Figure 4. Vertical section taken through the apparatus and its furnace.

Figure 5. Longitudinal section of the same apparatus separate from its furnace.

The same letters show the same parts in the two figures.

i i. Wall of the furnace.

j j. Grate supporting the fire.

l. Ash box.

m m. Vents or flues in which the flame circulates.

n n. Cylindrical boiler, or of any other appropriate form, having a cover, *o o*, sufficiently large to allow the introduction of an interior
902 cylinder, which will be described: the cylinder being introduced, the cover is fastened so that it shall be hermetically sealed.

p p. Cylinder supported by two trun'ions which pass through the boiler *n n* and through two stuffing-boxes not shown in the drawings, which boxes prevent any escape of steam.

The cylinder *p* is composed of a body upon which are fixed bands or sheets of metal, some of them having points *r r*, of three inches projection, and others having some holes half a line in diameter. These bands are placed alternately upon the body of the cylinder at a distance of two lines from each other.

s s. Journals upon which the cylinder turns; upon one of these journals is fitted a gear-wheel with a crank like *e f*, represented in *in* . Figure 1, for the first apparatus.

t t. Opening in the cylinder of proper size for introducing the materials to be operated upon.

FUNCTIONS OF THE APPARATUS.

The cylinder *p p* having been put in place, the material to be operated upon is introduced; the cover *t t* is then closed, but not hermetically. The proper quantity of lye is turned into the boiler *n* by the opening *o o*, which is to be closed hermetically.

The fire is kindled in the furnace and the cylinder put in motion.

The alkaline liquor penetrates into the cylinder through the holes pierced in it, and soaks the material enclosed. The materials are constantly picked in pieces by the points *r r*, and made to pass through the boiling lye, which rapidly purifies them and prepares them for the operation of bleaching by means of acids.

When this cleansing is finished the lye is drawn off, the fire extinguished, and pure water turned in for rinsing; the cylinder being

kept in movement meanwhile. The water is then drawn off and the operation is finished.

903 The same observations made in relation to the modifications which might be made in the first apparatus apply equally well to the second, both in regard to the form of the apparatus and to the manner in which the necessary movement is given to the apparatus.

This system of using ley and mode of preparation could be also used for threads and woven goods of cotton, linen, hemp, and all other materials which it is desirable to submit to this operation. In this case naturally the first apparatus would be preferred, inasmuch as the points in the second might damage the threads or the woven goods.

904 *Extracts from Amtlicher Bericht, ueber die Industrie Austellung, in London und Central Blatt, für Deutsche papier-fabrication. (Translation.)*

905 EXHIBIT No. 34.—R. E. STILWELL, *Examiner, &c.*

Central-Blatte for the manufacture of paper in Germany. No. 27, Sept., 1852, p. 499. Three communications.

ARTICLE FOR THE MANUFACTURE OF PAPER FROM CLOTH, WAST AND STRAW, IN ENGLAND.

From the notes to the official report of the London Industrial Exhibition, by Mr. William Oeschelhauser, who is well skilled in the art of manufacturing paper, (at present burgomaster of Mulheims.) For the sake of short notices we have ordered several copies, and recommend them to paper-manufacturers, since the admirable manner in which Mr. O. treats of this branch of industry furnishes many supplements to our report. (The ed.)

In England the manufacture of paper from straw differs from that in Germany, in this, that with us the reducing of the materials is accomplished more by mechanical means, while in England the straw is once or more boiled in a strong lye, under a pressure of from 6 to 8 atmospheres, (in Germany it is boiled in open vessels,) and consequently almost, as it were, dissolved. In addition, crushing-rollers are also used, similar to those in our oil-mills, so that almost no work at all remains for the grinding mills.

L. B. Wright, of (Chalford, near Stroud,) Gloucester, has carried the manufacture of the better sorts of paper, from straw alone, to the greatest extent, using straw without any addition of rags.

906 By reason of the high price of rags and the cheapness of coal, the manufacture of paper from straw has, in England, a more economical basis and an entirely different position from what it has with us.

For the manufacture of the ordinary kinds of paper the use of straw will certainly be upon the increase. On the other hand, it would be useless to wish to substitute the material for paper of the finer sorts.

EXHIBIT No. 35.—R. E. S., *Examiner, &c.*

Industrie Austellung zu London, 1851, vol ii, p. 342, note 4, note 8.

"4. The boiling of rags is mostly carried on in closed vessels, under a pressure of from 2 to 4 atmospheres. In later time various kinds of

revolving kettles (revolving boilers) are used, partially in form of an upright cylinder, which (just like the cylinders of an oscillating engine) turns upon trun'ions through which the steam enters, and partially in form of two cylinders, one fitting the other, of *of* which the outer one remains fixed and the inner one revolves around its axis."

* * * * * * *

8. In England the manufacture of paper from straw differs from the methods that are followed in Germany in these particulars:

With us the reduction of the materials is accomplished more by mechanical means, while in England the straw is boiled once or more in a strong lye, under a pressure of steam of from six to eight atmospheres, (in Germany it is boiled in open vessels,) and consequently, almost as it were, dissolved.

In addition, crushing-rollers are also used, similar to those in our oil-mills, so that almost no work at all remains for the grinding-mill. (Hollander.)

907 L. B. Wright, of Chalford, near Stroud, in Gloucester, has carried on the manufacture of the better sorts of paper, from straw alone, to the greatest extent, using straw without any addition of rags.

By reason of the high price of rags and the cheapness of coal, the making of paper from straw, has, in England, a more economical basis and an entirely different position from what it has with us. For the manufacture of the ordinary kinds of paper, the use of straw will certainly be upon the increase. On the other hand, it would be useless to undertake to substitute this material for paper of the finer sorts.

(Here follows diagram, marked page 907.)

908 EXHIBIT 36½.—R. E. STILWELL, *Examiner, &c.*

A. D. 1853.] [No. 1942.

Disintegrating and pulping vegetable substances.

Letters patent to Charles Watt, of 15 Selwood place, Old Brompton, and Hugh Burgess, of 7 Percy street, Bedford square, both in the county of Middlesex, for the invention of "improvements in disintegrating and pulping vegetable substances." Sealed October the 27th, 1853, and dated August 19th, 1853.

Provisional specification left by the said Charles Watt and Hugh Burgess, at the office of the Commissioners of Patents, with their petition, on the 19 August, 1853.

We, Charles Watt, of 15 Selwood place, Old Brompton, and Hugh Burgess, of 7 Percy street, Bedford square, both in the county of Middlesex, to hereby declare the nature of our invention for "improvements in disintegrating & pulping vegetable substances" to be as follows:

This invention has for its object better means than those at present practised for disintegrating and pulping vegetable substances for the manufacture of paper and other fabrics; for which purpose we
909 take, for instance, chips, shavings of wood, or sawdust, and boil for some hours in water. A stream of sulphurous acid is passed through the mass, till a partial bleaching is effected. The matters are then well washed, and placed in a solution of chlorine, chloric or chlo-

ous acid, also called the peroxide & protoxide of chlorine. The matters are kept in solution till quite white, and the fibres are disintegrated. Or, we employ chloride of sodium, decomposed by electric agency. After the above treatment we heat the fibrous mass in a warm and dilute solution of caustic soda or potash.

Specification in pursuance of the conditions of the patent-letters filed by the said Charles Watt & Hugh Burgess, in the great seal patent office, on the 18 Feb'y, 1854.

To all to whom these presents shall come:

We, Charles Watt, of 15 Selwood place, Old Brompton, and Hugh Burgess, of 7 Percy street, Bedford square, both in the county of Middlesex, send greeting.

910 Whereas Her most excellent Majesty, Queen Victoria, by her letters-patent, bearing date the nineteenth day of August, in the year of our Lord one thousand eight hundred and fifty-three, in the seventeenth year of her reign, did, for herself, her heirs, & successors, give and grant unto us, the said Charles Watt & Hugh Burgess, her special licence that we, the said Charles Watt & Hugh Burgess, our executors, administrators, & assigns should at any time agree with, and no others, from time to time, and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Island and Isle of Man, an invention for "improvements in disintegrating and pulping vegetable substances," upon the condition (amongst others) that we, the said Charles Watt & Hugh Burgess, by an instrument, in writing, under our hands and seals, or under the hand and seal of one of us, should particularly describe and ascer-

911 tain the nature of the said invention, and in what manner the same was to be performed; and caused the same to be filed in the great seal patent-office within six calendar months next and immediately after the date of the said letters-patent:

Now know ye that I, the said Charles Watt, on behalf of myself and the said Hugh Burgess, do hereby declare the nature of the said invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement thereof, that is to say:

This invention has for its object better means than those at present practised for disintegrating and pulping vegetable substances for the manufacture of paper and other fabrics; for which purpose we take, for instance, chips, shavings of wood, and sawdust, and boil for some hours in water. A stream of sulphurous acid is passed through the mass till a partial bleaching is effected. The matters are then well washed, and placed in a solution of chlorine, chloric, or chlorous acid, called, also, the peroxide and protoxide of chlorine. The mat-

912 ters are kept in the solution till quite white and the fibres are disintegrated. Or we employ chloride of sodium, decomposed by electric agency. After the above treatment we heat the fibrous mass in a warm and dilute solution of caustic soda or potash.

Having thus stated the nature of our said invention, we will proceed to describe the manner of performing the same. The wood, or vegetable substance on which it is intended to operate by this process, should be reduced by very fine shavings or cuttings—the finer the better. This may be done in any suitable machine. The shavings are then to be boiled in a solution of caustic alkali, the strength of which, being dependent on the nature of the vegetable substance operated on, can only learned by experience. For deal or fir wood we find that a

solution of alkali, of the strength indicated by 12° degrees of the English hydrometer, answers very well. The length of time necessary for this part of the process is somewhat dependent on the nature of
913 the vegetable substance to be treated. We find boiling in a solution of caustic alkali, under pressure, of considerable service. We do not claim this operation as a part of our invention. The shavings are then to be well washed and pressed. The washings may be saved, and evaporated down and burned in a suitable furnace, when they are again available for the same purpose. The damp shavings are now to be exposed to the action of chlorine, or compounds of chlorine with oxygen, till, on a portion being placed in a dilute solution of caustic alkali, the vegetable substance falls into a dark, pulpy mass. This part of the process is conveniently effected by placing the damp shavings on racks or drawers, about nine inches apart, one above the other, arranged in a chamber, allowing the chlorine, or the compounds of chlorine with oxygen, to enter the chamber and fill it. Of the compounds of chlorine with oxygen, we prefer that known as protoxide of chlorine, or hypochlorous or chlorous acid or euchlorine.

914 If found more convenient, the chlorine, or the compounds of chlorine with oxygen, may be used in aqueous solution instead of the gaseous form.

As soon as the shavings have been sufficiently acted upon by the gas, as may be ascertained by the method above described, they may be removed, and the hydrochloric, which is the result of the above, removed by washing, and the shavings well pressed. This should be done with as little water as possible, as this acid may be saved and made use of for the reproduction of chlorine.

The shavings are now to be placed in a weak solution of caustic alkali, when they will fall into a pulpy mass, of a dark brown color. This part of the process may be expedited by exposing the mass to the action of a beater or "engine," placed in the tank containing the solution of alkali.

915 The pulp obtained as above-described, having been freed from the alkali by washing, (which may be saved as before directed,) may now be bleached by the usual process, or, as we prefer, by chlorite or hypochlorite of soda or potash, liberating the chlorous or hypochlorous acid by hydrochloric acid.

In the above process we do not confine ourselves to the particular apparatus or utensils herein named, but claim the use of the chemical processes, and in the order herein stated.

In witness whereof I, the said Charles Watt, have hereunto set my hand and seal this twenty-third day of January, in the year of our Lord one thousand eight hundred and fifty-four.

CHARLES WATT. [L. S.]

Witness:

B. GOBEY, 4 *Old square, Lincoln's Inn.*

916 EXHIBIT NO. 37.—R. E. STILWELL, *Examiner.*

9030. 19 août 1863. Mess'rs Watt & Burgess, of London. Copie, (French.)

[2 series, volume 29, pages 189, 190. Printed 1858.]

9030. *Brevêt d'invention patente anglaise du 19 août 1853, en date du 28 septembre 1853, aux sieurs Watt et Burgess, de Londres, pour des perfectionnements dans la manière de désagréger et de rédiure en pâte des substance' végétale.*

Le bois, ou tout autre substance végétale, e't d'abord bien divisé au

moyen de toute machine convenable; plus la réduction est complète, plus les autres opérations s'accomplissent promptement.

On fait alors bouiller les copeaux, la paille hachée, etc., dans un bain d'une dissolution alcaline.

Si on emploie le bois de sapin ou de pin, la dissolution d'alcali doit être plus forte.

Cette dissolution poit avoir assez de force pour dépouiller les bois des matières résineuses.

On lave alors la matière ligneuse et on la place dans un bain fait avec un chlorure; nous préférons le chlorure de soude pour cette opé-
917 ration. On dégage l'acide c'loreux du chlorure par l'addition graduelle d'un acide en dissolution, qu'on introduit par le fond du vase contenant la matière ligneuse ou autre.

L'excès d'acide chloreux, dégagé du premier récipient, peut être conduit dans un second et dans un troisième au moyen d'un ap'areil connu sous le nom d'appareil de Woolf, communément en usage parmi les blanchisseurs et dans l'autres industries.

La quantité de chlorure de soude qu'il faut employer dépend de la nature de la matière ligneuse. Quelques bois exigent pour être blanchis une quantité plus forte d'acide chloreux, et l'expérience seule en indique la proportion.

La matière ligneuse ou autre doit séjourner dans la dissolution d'acide chloreux jusqu'à ce qu'elle soit devenue complétement blanchie; alors on enlève la masse blanchie.

On la lave avec soin et on l'arrose d'une dissolution chaude
918 d'alcali caustique étendue d'eau, jusqu'à ce que la matière ligneuse devienne d'une couleur sombre, et qu'elle soit convertie en une masse pâteuse.

Nous avous reconnu qu'il était très avantageux d'avoir un appareil chauffant dans le vase où on ajoute la dissolution d'alcali.

La pâte doit être chauffée par la vapeur ou par tout autre moyen convenable, jusqu'au point d'ébullition.

Lorsque la masse entière est convertie en une pâte ayant le degré de consistance requis on l'enlève; on la fait égoutter; on la lave avec soin, et enfin on la blanchit.

Pour cette dernière opération nous employons, de préférance, le chlorure de soude.

La quantité d'alcali caustique à employer dans la seconde opération dépend du résultat plus ou moins complet de la première.

En remplacement de l'acide chloreux nous pouvous employer le chlor', qui, vu son efficacité et le bon marché auquel on le produit, est même préférable.

919 Le bois haché, la paille, etc. sont placés dans de l'eau, dans des vases convenables, reliés ensemble, et formant un appareil de Woolf.

Le chlore obtenu au moyen d'un procédé quelconque est passé par la série de ces vases.

Le bois, etc., peut être mo'illé et exposé à l'action du chlorure sur des claies.

On l'y laisse séjourner pendant un laps de temps suffisant; on peut s'en assurer en plaçant dans de l'alcali caustique étendue d'eau une petite quantité de bois, et si l'opération est achevée la couleur devient sombre et les fils se désagrègent; alors on traite la masse de la manière que nous avons expliquée auparavant.

EXHIBIT No. 38.—R. E. STILWELL, *Examiner, &c.*

9030. August 19th, 1853. Messrs. Watt & Burgess, of London. (Translation.)

9030.—*Patent of invention, (English patent of the 19th August, 1853,) dated 28th September, 1853, to Messrs. Watt & Burgess, of London, for improvements in the method of disintegrating vegetable substances and reducing them to pulp.*

Wood or any other vegetable substance is first well divided up by any machine adapted to the purpose. The completer the reduction the more promptly are the other operations effected.

The chips, cut straw, etc., are then boiled in a bath of an alkaline solution.

If pine or fir wood is used the alkaline solution should be stronger.

This solution should be of sufficient strength to divest the wood of the resinous matters.

The woody matter is then washed and put in a chloride solution We prefer chloride of sodium for this operation. The chloric acid is disengaged from the chloride by the gradual addition of an acid in solution, which is introduced at the bottom of the vat containing the woody or other matters.

The excess of chloric acid disengaged from the first receptacle, can be conducted to a second, and from thence to a third, by means of an apparatus, known by the name of "Woolf's apparatus," in com-
921 mon use with bleachers, and in other industrial work.

The quantity of chloride of sodium to be employed depends on the nature of the ligneous matter, some woods requiring a larger quantity of chlorid acid to bleach them, and experience alone can indicate the proportion to be used.

The ligneous or other matters should remain in the solution of chlorid acid, until they have become perfectly white. The bleached mass is then taken out.

It is washed with care and then sprinkled with a solution of warm caustic alkali, until the ligneous matter becomes of a dark color, and is converted into a pulpy mass.

We have found it very advantageous to have a heating apparatus in the vat where the alkaline solution is added.

The pulp should be heated by steam or any other convenient method to the boiling point.

When the entire mass is converted into a pulp of the desired consistence, it is taken out. It is then drained, carefully washed, and, lastly, it is bleached.

For the last-mentioned operation we prefer to employ chloride of sodium.

The quantity of caustic alkali employed in the second operation depends upon the completeness of the first.

To replace the chlorid acid we can use chlorine, which, on ac-
922 count of its efficacy and the cheapness of the cost of production, is even preferable.

The wood, cut straw, etc., is placed in water, in convenient vats, joined together, and forming a "Woolf's apparatus."

The chlorine obtained by any process is passed through the series of vats.

The wood, etc., can be dampened and exposed on shelves to the action of the chlorine.

It is allowed to remain there a sufficient length of time; and to ascertain if the process is completed, a small quantity of the wood is placed in a solution of caustic alkali, and if the operation is completed, the colour becomes dark, and the threads separate. Then the mass is treated in the manner we have already described.

(Indorsed:) Watt & Burgess. Patent of 28th Sept., 1853. Translation of French patent.

EXHIBIT No. 39.—R. E. S., *Ex'r.*

5605. 17 mai 1851. Sieurs Coupier et Mellier, Paris. Copie, (French.)

923 Brevêt d'invention, 2d series, vol. 19, pages 145, 146, and 147. Printed 1855.

5605. *Brevêt d'invention de quinze ans, en date du* 17 *mai* 1851, *aux sieurs Coupier et Mellier, à Paris, pour des moyens de réduire les matières végétales fibreuses en pâte propre à servir à la fabrication du papier blanc.*

Un premier procédé, plus spécialement applicable au traitement des matières herbacées et des diverses écorses, quoiqu'il puisse s'appliquer également au traitement des bois, consiste dans l'emploi d'une solution d'hydrate de soude ou de potasse marquant de 8 à 10 degrés, à l'aréomètre de Baumé.

La matière à traiter doit être soumise à l'action de cette solution pendant huit ou dix heures et à la température de 100 à 110 degrés centigrades.

Après avoir écoulé les eaux, dont nous diront tout à l'heure l'emploi, on lave avec soin jusqu'à ce que l'eau sorte claire; la matière, alors suffisamment désorganisée, est mise dans un bain d'hypochlorite
924 d'alumine à raison de 8 à 10 kilogrammes de cet hypochlorite, supposé sec, pour 100 kilogrammes de la matière brute. En la laissant séjourner huit heures environ dans ce bain, où on l'agit fréquemment pour que l'action s'exerce sur toutes les fibres, on obtient une pâte d'un beau blanc et d'une grande pureté. On égoutte alors, et après un lavage à l'eau bouillante, qui a pour effet de décomposer l'hypochlorite restant dans la pâte et d'achever la désagrégation des fibres ligneuses, il ne reste plus qu'à raffiner cette pâte par les moyens usités pour la pâte de chiffon, en observant toute fois que les lames du cylindre et de la platine, dont on se servira, doivent être arrondies.

En cet état, la pâte peut être employée en mélange avec la pâte de chiffons dans des proportions variables et donner d'excellent papier.

Les liqueurs que l'on a fait écouler, ainsi que les premières eaux de lavage, sont mises à évaporer dans la cuvette d'un four à réverbère jusqu'à consistance épaisse. On obtient ainsi un savon résineux,
925 qui seul, ou en mélange avec du poussier de tan ou de charbon de bois, etc., fournit un combustible facile à utiliser dans le four même pour aider à l'évaporation des liqueurs d'une opération suivante. Les cendres résultant de la combustion de ce savon rendent à l'ixiviation presque tout l'alcali qui a servi à l'opération, car la perte subie ne s'élève pas à plus de 15 à 20 p. % de la quantité employée.

Les avantages du procédé que nous venons de décrire consistent:

D'abord dans la simplicité des opérations à faire et dans l'économie qui en résulte, mais tout particulièrement:

1°. Dans l'emploi de la solution d'hydrate de soude ou de potasse, au degré que nous avons indiqué.

2°. Dans celui de l'hypochlorite d'alumine également au degré indiqué. À cet état de concentration l'hydrate alcalin dissout complétement les matières résineuses contenues dans les végétaux, rend libre la silice et les sels terreux, et laisse à nu le' fibres du ligneux de
926 manière à permettre de les blanchir, sans autre opération intermédiaire, dans une solution d'hypochlorite d'alumine.

Nous insistons sur l'emploi de cet hypochlorite, de préférence à tout autre, à cause de la facilité avec laquelle l'alumine, qui est une base faible, cède son acide hypochloreux; d'où résultent:

1.° Une plus grande rapidité dans l'opération.

2°. On blanc plus parfait.

Néanmoins on peut obtenir un blanchiment plus ou moins complet avec les autres hypochlorites.

Quant au mode d'emploi de ces deux agents, les hydrates alcalins et les hypochlorites indiqués ci-dessus—c'est-à-dire, quant à la forme des appareils dans lesquels on les fera agir—cela peut varier beaucoup; le meilleur système à suivre sera toujours celui qui permettra, sur une quantité donnée de matière végétale, d'employer la moindre quantité possible de liquide.

Ainsi pour l'hydrate alcalin, le moyen qui nous a paru devoir
927 être préféré à cet usage, comme aussi pour son application au lessivage des cordes et des chiffons employés en papeterie, consiste à jeter sur les matières à traiter, au travers d'un arrosoir, et au moyen de la pression de la vapeur ou de la force ascensionnelle résultant de l'ébullition dans un vase clos, une quantité de liquide qui, après avoir traversé la masse, rentre dans le vase d'où il a été projeté, pour être rejeté encore, et ainsi de suite jusqu'à ce que la désorganisation des matières végétales soit complète. Par ce moyen, on peut réduire la quantité des liquides employer à environ trois cents litres pour 100 kilogrammes de matière brute et diminuer ainsi considérablement les frais d'évaporation.

Quant au bain d'hypochlorite, on peut indifféremment le faire dans des agitateurs comme ceux usités en papeterie, ou dans des piles en bois avec cylindres en bois, ou dans tout autre appareil du même genre. Moins on mettra d'eau plus, par conséquent, la liqueur sera concentrée, plus aussi l'action sera rapide et complète. La proportion d'eau ne doit pas dans tous les cas dépasser 600 litres pour 100 kilo-
928 grammes de matière brute.

Si c'est de la paille que l'on veut traiter, il faut la nettoyer avec soin et la purger des herbes parasites qu'elle peut contenir.

Nous devons dire aussi qu'il y a avantage à couper la paille avec les hache-pailles ordinaires, l'action paraissant se faire ainsi d'une façon plus uniforme, les nœuds particulièrement étant ainsi atteints plus à fond. Toutefois on peut parfaitement s'en dispenser, surtout si on soumet préalablement la paille à un laminage ayant pour effet d'écraser ces mêmes nœuds et de les ouvrir pour en rendre le cœur plus facilement accessible à l'action de l'hydrate alcalin.

Mais ces deux opérations ne sont, ni l'une ni l'autre, absolument indispensables.

Le deuxième procédé, plus particulièrement applicable au traitement des bois, consiste dans l'emploi de l'acide nitrique pour la réduction en pâte de la matière à traiter et dans l'extraction de l'acide oxalique, que l'on peut retirer des liqueurs par évaporation, plus d'un acide
929 analogue à l'acide nitropiorique, comme produit pouvant servir à la teinture des laines et des soies.

La matière à traiter après division convenable doit être soumise à l'action d'une solution d'acide nitrique marquant de 5 à 6 degrés au pèse-acide.

On prend, par exemple, du bois que l'on effile ou que l'on rabote, et on entasse les copeaux dans des cuviers en bois, de façon à laisser le moins de vide possible; on remplit ainsi deux cuviers.

Ces cuviers sont munis de faux fonds en bois, percés de trous élevés d'environ 5 centimètres au dessus du fond, et de couvercles, joignant aussi exactement que possible sur les bords du cuvier. Les couvercles sont munis eux-mêmes d'un grillage ou d'un faux couvercle en bois percé de trous, lequel doit entrer avec aisance dans le cuvier et y descende à une profondeur d'environ 20 centimètres, de manière à laisser entre le couvercle et le faux couvercle un espace vide.

Les deux cuviers étant chargés, on verse dans l'un d'eux de l'acide nitrique étendu d'eau et marquant de 5 à 6 degrés au pèse-acide, de manière à baigner tout' la masse; on laisse agir pendant environ
930 quatre heures, puis on porte le liquide à l'ébullition au moyen d'un jet de vapeur arrivant par le bas du cuvier; la durée de l'ébullition est d'environ deux heures.

Pendant l'opération, il se dégage d'abondantes vapeurs nitreuses, que l'on fait passer dans le deuxième cuvier, au moyen d'une communication en grès ou en plomb, prenant du haut du cuvier en action pour se rendre dans le bas du second cuvier, après avoir eu soin d'humecter les copeaux dont il est rempli; un courant d'air alimenté par un ventilateur est ménagé dans le bas de ce second cuvier, et a pour but de transformer les vapeurs nitreuses en acide hyponitrique, lequel agit déjà en préparant la matière qui sera à traiter dans l'opération suivante.

L'opération terminée, on égoutte le liquide, que l'on peut reverser immédiatement dans le second cuvier.

Après égouttage complet, la matière est lavée, puis transporté dans un cuvier garni d'une toile métallique reposant sur un grillage en bois servant de faux fond, pour recevoir l'action d'une solution d'hydrate de soude ou de potasse marquant de 1 à 2 degrés à l'aréomètre, portée
931 à l'ébullition pendant environ deux heures, puis lavée et transportée dans un appareil convenable pour être blanchie comme il est dit dans le premier procédé. Seulement, la dose d'hypochlorite d'alumine à employer par 100 kilogrammes de matières brute se réduit ici à 4 ou 5 kilogrammes d'hypochlorite, supposé sec. La pâte ainsi obtenue peut être employée comme il est dit précédemment.

La matière garnissant le second cuvier ayant reçu l'action des vapeurs nitreuses est soumise à une opération exactement semblable, sauf que l'on a ajouté avec les liqueurs sortant du premier cuvier une quantité d'acide nitrique à 36 degrés, équivalente à 40 p. % du pois de la matière brute.

Les opérations peuvent se continuer ainsi, par les mêmes liqueurs, huit ou dix fois. Au bout de ce temps, les liqueurs étant suffisamment concentrées pour être évaporées, il faut prendre des liqueurs nouvelles.

L'évaporation se fait au bain-marie dans des vases en grès, et par le refroidissement on obtient l'acide oxalique cristallisé, que l'on
932 purifie par les moyens ordinaires. Les eaux mères contiennent le principe colorant que nous avons indiqué.

Les bois le' plus convenables à traiter par ce moyen sont les bois de hêtre, de sapin, et de charme. Le mérite de ce second procédé consiste dans l'emploi de l'acide nitrique à forte dose, l'utilisation des vapeurs nitreuses, et l'obtention, en sus de la pâte, d'un principe colorant très-riche et de l'acide oxalique.

933 EXHIBIT No. 40.—R. E. S., *Examiner, &c.*

5605. May 17th, 1851. Messrs. Coupier and Mellier, of Paris. (Translation.)

5606.—*Patent of* 15 *years, dated May 7th,* 1851.—*To Messrs. Coupier & Mellier, of Paris, for methods of reducing vegetable fibrous materials to pulp, suitable for the manufacture of white paper.*

A preliminary process, more especially applicable to the treatement of herbaceous materials, and different kinds of bark, although it can be applied equally well to the treatment of wood, consists in the use of a solution of hydrate of soda or potash, marking from 8 to 10 degrees by the areometer of Beaumé.

The material under treatment is to be submitted to the action of this solution during eight or ten hours and to the temperature of one hundred and ten degrees centigrade.

After these liquors are drawn off, (the use of which I shall presently speak of,) the material is carefully washed until the water flows off clear. The material, which is then sufficiently desorganized, is placed in a bath of hydrochlorite of alumina, in the proportion of eight
934 to ten kilogrammes of this hypochlorite, supposed in the dry state, to 100 kilogrammes of the raw material.

By leaving the material in this bath for about eight hours, (where it is often stirred, so that *on* all the fibres may be acted on better,) a pulp is obtained, which is of a beautiful white and of great purity. It is then drained, and after being washed in boiling water, which decomposes the hydroclorite remaining in the pulp, and completes also the disintegration of the ligneous fibres. It only remains to refine this pulp by any of the means used ordinarily for the rag-pulp, taking care, however, that the blades of the cylinder and those of the plate used, be rounded.

In this condition the pulp can be employed, mixed with pulp from rags, in variable proportions, and will produce excellent paper.

The liquids that are drawn off, as well as the first washing waters, are placed in a basin in a reverberatory furnace, till they are of a thick consistency. There is thus obtained a resinous soap, that either alone or mixed with tan or charcoal, refuse, etc., furnishes a fuel that can easily be made use of in the furnace itself to aid in the evaporation of the liquors of a subsequent process. The ashes resulting from the combustion of this soap, renders up by lixiviation almost all the alkali which has been used in the operation, for the loss does not amount to more than 15 to 20 % of the quantity used.

935 The advantages of the process, which we will describe, consist:

Foremost in the simplicity of the operations to be done, and in the savings resulting out of it, but more especially—

1st. In the use of the solution of hydrate of soda or of potash to the amount we have mentioned.

2d. In that of the hydrochlorit' of alumina, also to the amount stated.

This is what constitutes the merit of our invention.

At this state of concentration the hydrate alcaline dis'olves completely the resinous matters contained in the plants, frees the silex and earthy salts, and leaves naked the fibres of the woody or ligneous part, in such a manner that they are bleached without any intermediate operation in a solution of hypoclorit' of alumina.

We insist on the use of this hydrochlorit' in preference to all others, by reason of the facility, with which the alumin, being a weak
936 basis, gives off its hydrochlorous acid; from which results:

1st. A greater rapidity of operation.

2d. A most perfect white.

Notwithstanding, a more or less complet' bleaching can be obtained with the other hydrochlorit's.

In regard to the mode of using these two agents, the hydrates of alcalina and the hydrochlorit's above noticed, it is to say, concerning the form of the apparatuses in which they will be treated, that they can vary to a great extent. The best system to follow will always be that, which will permit the use of the least possible quantity of liquid on a given quantity of vegetable matter.

In this manner, what has seemed to us for the hydrate of alcalin the means which should by employed for this use, as also for it' application to treatment of lye of ropes and rags, used in paper-manufacture, consists to throw on the materials to be treated, through a sprinkler and by means of steam-pressure or by the ascensional force re-
937 sulting from the boiling in a closed vessel a quantity of liquor, which, after having passed through the masse, re-enters the vessel from which it has been projected, for to be projected again, and so further, till the disorganisation of the vegetable material be complet'.

In this way, the quantity of *of* the liquids employed can be reduced to about 300 litres to 100 kilogramme' of raw material; and the cost of evaporation will be considerably reduced.

In regard to hydrochlorit' bath, it can be done promiscuously in the agitateurs, like those used in the paper-manufacture, or in the wooden beating-troughs, with wooden cylinders or in any other apparatus of the same kind. The less water is added, the stronger will be, in consequence, the liquor. The action will also be rapid and complete. The proportion of water must in no case surpass 600 litres to 100 kilogramme' of the raw material.

938 If it be the straw which is desired to treat, it must be wetted with care and cleaned of the parasite herbes it may contain.

We must mention, also, that it is advantageous to cut the straw on a common straw-cutter. The action seems to take place more uniform, the knots being particularly reached more at the heart.

It may, although, be dispensed with, especially when the straw is previously submitted to a crushing, having for effect to break these same knots and to open them, for to make the heart of them easier accessible to the action of the hydrate alcaline.

But both of these operation' are not absolutely indispensable.

The second process, more particularly applicable to the treatement of wood, consists in the use of nitric acid for to reduce the material to be treated to pulp, and in the extraction of the oxalic acid, which can be gained from the liquid by evaporation, and also, an acid analogous to the nitropicrique acid, as a produce, which can be used for
939 dying woolen goods and silk.

The material to be treated, must, after suitable reduction, be submitted to the action of a solution of nitric acid, which markes about 5 to 6 degre's on the hydrometer.

Wood is taken, for example, which has been reduced or planed. The shavings are heaped in wooden vats in such a manner, so as to leave, as *as* little as possible empty space. Two of these wooden vats are thus filled.

These vats are constructed with false wooden bottoms pierced with holes, elevated about 5 centimeter' above the bottom, the covers fitting as tight as possible on the rim of the vat. These covers are constructed themselves with grating or a false wooden cover pierced with holes, which must pass freely into the vat and must reach down into it to about 20 centimeter', leaving between cover & false cover an empty space.

The two vats being charged, nitric acid is poured into one of
940 them, the nitric acid being mixed with water and marquing from 5 to 6 degre's on the hydrometer, in such a manner so as to bath' the whole mass. This is allowed to act for about four hours. Hereon the liquid is brought to boiling by means of jet of steam entering in the bottom of the vat. The time of boiling is about two hours.

During the operation quite a quantity of nitrous vapour is evolved, which is made to pass over to the second vat, by means of a stoneware or leaden communication, taking it from the top of the vat in action, for to pass to the bottom of the second vat, after having taken the precaution to moisten the shavings with which it is filled. A current of air, fed by a blower, is brought in at the bottom of this second vat. The purpose of this is to change the nitrous vapors to hydronitric acid, which acts already in a preparing manner on the material which will be
941 treated in the succeeding operation. The operation finished, the liquid is made to flow off, and may be passed over directly to the second vat.

The liquid being drained off, the material is washed, then brought to a vat lined with mettal'ic cloth resting on wooden grating, which serves as false bottom for to receive the action of a solution of hydrate of soda or potash, marking from 1 to 2 degre's on the areometer, brought to the state of boiling, then washed and transported in a suitable apparatus, to be bleached as has been described in the first proces'. The ooze of hydrochlorit' of alumina used, through 100 kilogramme of raw material, is reduced only to 4 or 5 kilogramme' hydrochlorit', *excepted* to be dry. The pulps so obtained, can be employed as is stated before.

The material fitted in the second vat having received the action of the nitrous gases, is submitted to an exactly similar operation, except that there has been added to the liquors coming from the first
942 vat, a quantity of nitric acid at 36 degrees, equivalent to 40% of the wkeight of the raw material.

The operations can be so continued with same liquors eight to ten times. It is necessary to take at the end of this time new liquors, the others being sufficiantly concentrated for to be evaporated.

The evaporation is done in a steam-bath in stone jars, and by the cooling off is obtained the oxalic acid in a crystaline state, which is purified in the usual manner. The mother-water contains the coloring power of which we have spoken.

The most convenient wood to treat by this proces' is the beech, pine, and the horn-beam wood. The merits of this second process consists in the use of nitric acid in strong doses in the making use of the nitrous vapours, the gaining over and above the pulp, of a very riche coloring matter and of oxalic acid.

943 EXHIBIT No. 41.—R. E. STILWELL, *Examiner, &c.*

1440. 12 février 1846. Mr. Cothon-Breuil, Paris. Copie, (French.)

[Brevêt d'invention, 2d series, vol. 6th, pages 60 and 61. Printed 1851.]

1440. *Brevêt d'invention de quinze ans, en date du 12 février 1846, au sieur Cothon-Breuil, à Paris, pour l'emploi des écorces de végétaux dans la fabrication du papier.*

Voici les diverses opérations que l'on fait subir aux tiges de soule et d'osier:

1°. DÉCORTICAGE.

Ce décorticage peut avoir lieu de différentes manières. Le procédé qui nous a paru préférable consiste à faire passer les tiges dans une espèce de filière composée de deux portions de cercle pratiquées à deux plaques de tôle, et dont les bords sont taillés en biseau. En supposant ces deux plaques superposées dans leur épaisseurs et maintenue' l'une au-dessus l'autre, on comprend qu'on peut diversifier à volonté le diamètre de ce filières. Tout autre procédé, tout' autre combinaison reposant sur l'emploi de filières à bords aigus, décortiquant la branche qu'on y fait passer, peut remplir, plus ou moins bien, le même but, qui est d'enlever l'écorce sans la briser ou la broyer, afin que les filaments qu'elle contient ne soient pas coupés dans leur longueur. Nous devons faire remarquer que s'il y a avantage, pour la facilité de l'opération du décorticage, à choisir le moment de la sève, ce moment est, d'un
944 autre côté, celui où les filaments sont moins résistants. Nous avons donc cherché à concilier ces deux cas et c'est ce que nous avons fait en soumettant à l'action de la vapeur les branches sèches, qui acquièrent par ce moyen la faculté d'être décortiquées aussi bien qu'à l'état de sève.

2°. PRÉPARATION DES ÉCORCES.

On commence par faire subir à la matière un lessivage au sel de soude, (1 kilogramme de sel pour 100 kilogrammes de matière,) en laissant bouillir, pendant cinq à six heures environ, sous une vapeur de deux à trois atmosphères; puis on soumet la matière de meules à chanvre, en ayant soin de s'assurer que toutes les parties qui entourent les filaments sont bien écrasées. On lave ensuite dans des paniers et à grande eau courante, ce qui débarrasse entièrement les filaments de toutes les matières étrangères qui ont été attaquées par le lessivage et l'écrasage. On procède encore à un second lessivage, au savon vert, (1 k. 50 de savon pour 100 kilogrammes de matière,) sous une température moins élevée et pendant environ quatre heures. Enfin on termine par un second lavage au panier avant de procéder au séchage, soit au
945 soleil, soit à l'air, soit par tout autre moyen connu.

3°. PEIGNAGE DE FILASSE.

Les filasses que nous avons obtenues des préparations décrites précé lemment ont été soumises au peignage comme on le pratique à l'égard du chanvre. Il en est resulté des fils qui nous ont paru propres à être travaillés comme le lin et le chanvre, pour servir comme ces matières

dans le tissage. On conçoit que, pour ne pas altérer ces fils et pour leur laisser le nerf, nous ayons rendu nos lessives peu ou point caustiques. Aussi nos fils présentent-ils une teinte un peu foncée; mais leur blanchiment dût-il, étant pratiqué à l'égal de celui qu'on fait subir au lin et au chanvre, rendre ces fils moins résistants que leur emploi à l'état écru serait—encore un avantage immense pour l'industrie. Nous ajouterons que les étoupes provenant du peignage de ces filasses étant débarrassées de tous corps étrangers, il a été facile de la convertir, au moyen de l'emploi des procédés de blanchiment connus, en une
946 pâte blanche et d'une qualité supérieure à celle même des chiffons communs, sur lesquels ces étoupes ont l'avantage d'avoir une ténacité qui s'explique par leur essence analogue à celle du chanvre sans avoir la chévinotte qui ne peut s'extraire entièrement des étoupes de cette dernière plante.

4°. Emploi de l'écorce pour faire de pâte à papier, sans séparation préalable des filaments d'avec la pellicule.

Les écorces provenant du décorticage exécuté par les procédés décrits précédemment, ou mêmes celles provenant du travail de la vannerie, sont coupées en morceaux de 4 à 8 centimètres de long. On les jette dans l'eau bouillante; puis après avoir décanté, au bout d'une heure environ, on jette dans le cuvier, sur la matière et à l'état d'ébullition, une lessive, composé de 2 kilogrammes de sel de soude et 1 kilogramme de chaux dissous dans 300 litres d'eau par 100 kilogrammes d'écorces. Après une ébullition d'environ quatre heures, et avant de décanter, on ajoute 50 décagrammes d'acide sulfurique étendue dans 300 litres d'eau.
Une demie-heure après, cette première opération est terminée, et on
947 place la matière dans une caisse couverte, où on la laisse macérer pendant quarante-huit heures. Il serait toutefois préférable de laisser séjourner la matière dans la lessive pendant vingt-quatre heures avant de l'en retirer, et au lieu de la placer dans une caisse. La matière ainsi traitée on la passe au cylindre défileur, en ayant soin de ne faire agir le cylindre que très-légèrement sur la platine, afin d'effilacher, pour ouvrier la matière sans la broyer, dans le but d'en fair' détacher les pellicules, le parenchyme, la crasse, le gluten et autres corps étrangers aux filaments. Une heure d'un fort lavage suffit à cet effet, et on obtient ainsi une belle filasse, qu'on fait défiler par le même cylindre, et qu'on peut porter ensuite aux cylindres raffineurs. On met ensuite la matière dans les cuviers, et l'on obtient une pâte d'une qualité supérieure, quoique ayant une teinte foncée. Dans le cas où l'on voudrait fabriquer avec cette même pâte des papiers blancs, on la soumettrait à la presse et au blanchissage, de la même manière qu'on le fait pour les chiffons.

948 5°. Emploi des branches ou tiges de soule et d'osier, avec ou sans écorce, pour faire de la pâte à papier.

Les opérations de lessivage et de lavage sont les mêmes que pour l'écorce seule; mais comme le bois offre plus de résistance à l'écrasement que l'écorce, il faut dans ce cas employer un pilon ou laminoir, au lieu de la maille à chanvre. On comprend que la couleur foncée de l'écorce devra faire préférer l'emploi du bois seul décortiqué, à moins qu'il ne s'agisse de menues branches de saule et d'osier, dont le décorticage serait trop difficile, ou bien dont l'écorce ne nuirait pas à l'emploi simultané du bois et des écorces, ce qui arrivera quand les branches ou pousses seront jeunes, de quelque grosseur qu'elles soient d'ailleurs.

6°. EXTRACTION DE MATIÈRE COLORANTE DES DITES ÉCORCES.

En récuillant les eaux des lavages et des lessivages, et en y ajoutant de l'acétate de plomb liquide, nous avons obtenu un précipité considérable formant une sorte de chromate rouge, propre à la teinture, et qui constitue un nouveau produit, non encore obtenu jusqu'à ce jour de ces écorces.

949 EXHIBIT No. 42.—R. E. S., *Ex.*, &c.

1440. Febr. 12th, 1846. Mr. Cothon Breuil, of Paris. Translation.

1414.—*Patent for* 15 *years, dated February* 12*th*, 1846.—*To Mr. Cothon Breuil, of Paris, for the employment of vegetable bark in the manufacture of paper.*

Here follow the different operations. The stems of the willow and osier are subjected to:

1. REMOVING OF THE BARK.

The removal of the bark can take place in many different ways. The process that seems preferable to us consists in passing the stems through a kind of draw-plate, made up of two parts of a circle cut from two plates of iron, the edges of which are bevelled.

Supposing these two plates placed over each other in their thickness, and held one above the other, it is understood that the diameter of this draw-plate may be changed at will. Every other process, every other combination, depending upon draw-plates with sharpened edges, strip-
ping the bark from the branche' passing through it, can accom-
950 plish more or less perfectly the same result, which is, to remove the bark without breaking or bruising it, so that the fibres which it contains shall not be cut in their length. We should remark that it be advantageous for the operation of removing the bark to choose the time of the sap—this being, however, the time when the fibres have the least strength. We have therefore endeavored to reconcile these two cases, and this we have done by submitting the dry branches to the action of steam, which are rendered by these means as easy to be unbarked as in the time of the sap.

2. PREPERATION OF THE BARK.

First the material is submitted to the action of a lye of soda-ash, (1 kilogramme of soda to 100 kilogrammes of the material;) then letting it boil for about five to six hours under two to three atmospheres of steam; then the material is placed in a hemp-mill, taking care to assure
that all the parts surrounding the fibres be well crushed; then it
951 is washed in baskets in a strong current of water, which frees the fibres well of all foreigne substances that have been acted upon by the lye or the act of crushing. It is proceeded now to a second treatment with lye of soft soap, (1.50 kilogramme' of soap to 100 kilogramme' of the material,) under a temperature less high and for about 4 hours. Finally the operation is ended before proceeding to drying by a second washing in baskets. The drying is either done in the sun, the air, or by any other known means.

3. Combing the tow.

The tow, which has been obtained by the preparations previously described, is submitted to a combing such as is usually given to hemp. The result has been, threads which have appeared to us adapted to be worked like flax and hemp to serve like these materials in weaving. It
952 may be seen that, in order not to injure the threads, and leave them their strength, we have made our lyes very little or not at all caustic. Our threads present, also, of somewhat a deep shade, but their necessary bleaching, done similar to that practised on flax and hemp, without making the threads less strong, as in the unbleached state, would be an immense advantage to the industry. We add that the tow resulting from the combing of these fibres, being freed from all foreigne substance, has been easily converted by any of the well-known processes of bleaching into a white pulp of a quality even superior to that of common rags, over which these materials possess the advan'ge of having tenacity, explained by their nature being like hemp, without the stalk, that cannot be extracted from the tow of the latter plant.

4. Use of the bark for making paper without previous seperation of the pellicle.

The bark, stripped of by the process previously described, or
953 even that coming from basket-making, is cut into bits of 4 to 8 centimeters in length. These are thrown in boiling water, and then, at the end of about an hour, after the water is decanted, there is thrown upon the material in a boiling state a lye, composed of 2 kilogrammes of soda-ash and one kilogramme of lime, dis'olved in 300 litres of water for 100 kilogrammes of bark. After this has boiled for about four hours, and before it is decanted, there are added 50 decagrammes of sulphuric acid diluted in 300 litres of water. Half an hour after this, this operation is ended, and the material is placed in a covered vat, where it is left to macerate for forty-eight hours. It will sometimes be preferable to leave the material in the lye for twenty-four hours before drawing it off, in place of putting it in the vat.

The material thus treated is pass' to the half-stuff cylinder-
954 engine for tearing it to fibres, taking care to have the cylinder move but lightly over the block to unravel it, in order to open the material without breaking it, for the purpose of detaching from it the pellicles, the skin-film, the dirt, the gluten, and other matters strange to the fibres. A thorough washing of an hour accomplishes this, and we thus obtain a beautiful tow that can be torn up by the same cylinder-engine, and than taken to the refining-cylinders.

The material is now put into vats. The pulp as obtained is of a superior quality, although of a deep color. When it is desired to make white paper with this same pulp, it is pressed and bleached in the same manner as rags.

5. Employment of the branches of the willow and osier, with or without bark, to make paper-pulp.

The operation' of treating with lye and of washing are the same as for the bark alone; but the wood offering more resistance to the crush-
955 ing *as* the bark, a stamper or roller must be employed in this case instead of the hemp-mill. It is understood that the deep color of the bark would make the use of wood alone, freed of its bark, prefer-

ble, unless the small branches of the willow and osier come not in ques-ion, the unbarking of which would be too dif'icult, or else when the ark would not hurt much the simultaneous use of wood and bark, hich would take place when the branches or shoots will be young, of hatever thickness they might be else.

6. EXTRACTION OF THE COLORING MATTER.

By gathering the liquids of the washing and treatment with lye, and lding to it acetate of lead in liquid state, we have obtained a consid-able precipitate, which is a kind of red chromate, adapted for dy'ing, hich constitutes a new product, never obtained till now from this bark.

6 EXHIBIT NO. 43.—R. E. S., *Examiner*, &c.

399. 12 mars 1839. Mr. Moinier Legoux, Paris. Copie, (French.)

(Here follows diagram marked page 956.)

revêt d'invention, 1st series, vol. 52, pages 413, 414, and 415, and plate 26. Printed 1844.]

99. *Brevêt d'invention de cinq ans, en date du 12 mars 1839, au sieur Moinier Legoux, à Paris, pour la fabrication de la pâte à papier avec toute espèce de bois préalablement réduits en copeaux : écorces, racines, feuilles, graminées, roseaux, pulpe de racines tuberculeuses légumineuses, paille de froment, foin, herbes, mousses, herbes aquatiques, plantes marines, et enfin tous végéteaux de quelque nature qu'ils soient, le tout ou moyen d'ap'areils mécaniques et de procédés chimiques nouveaux ou de nouvelle application.*

La dite pâte servant à fabriquer le papier de toute espèce, le carton nple et le carton double.

L'objet de ce brevêt est l'application des procédés mécaniques et imiques qui ont été désignés ci-après pour convertir, en pâte propre à fabrication du papier, les matières dont il est fait mention ci-dessus.

DESCRIPTION—PREMIÈRE OPÉRATION—PROCÉDÉS MÉCANIQUE.

La première opération, qui consiste à effiler la matière destiné à la fabrication de la pâte, se fait avec le secours de la machine dont la description et les plans sont vus, pl 26e.

l suffit d'étaler la matière sur une toile sans fin qui la conduit dans cylindres cannelés ; ceux-ci la délivrent à la râpe, au fur et à mésure ils la reçoivent, et la retiennent dans le cas où la râpe tendrait à traîner ; dès qu'elle se trouve mise en contact avec les dents de la râpe, est instantanément réduite en filaments plus ou moins longs. Cette chine est désignée comme étant un des moyens par lesquels on peut uire toutes les matières énoncées en tête du présent mémoire, en une es-e de *de* filasse ressemblant au défilé produit par les chiffons. Un autre yen pour lequel le soussigné réclame aussi le privilége, du moins nt à son application à la fabrication de la pâte à papier, est de couper natière en longueur de 15 à 20 centimètres, puis la soumettre à une chine presque semblable à celles employées dans les filatures pour oton lorsqu'il a été pressé dans les balles ; cette machine est com-posée d'un, deux ou trois tambours, en fonte armée de dents de fer, tournant à une grande vitesse et passant au milieu d'autres dents

fixées dans des traverses en fonte, placées à l'extérieur du tambour; les morceaux de matière, en passant entre les rangées de dents, se diviseront en filaments et donneront le produit désiré. À cette machine peuvent s'appliquer une toile alimentaire et une mécanisme qui fera ouvrir et fermer, à des intervalles exigé's, les portes par lesquelles la matière entre dans la machine ou en sort en défilé.

Cette machine pourrait être remplacée par des pilons, ou par les cylindres employés ordinairement dans les papeteries.

Il y aurait probablement encore d'autres moyens mécaniques par lesquels on pourrait réduire la matière en défilé; mais dans cet état, elle serait encore impropre à être convertie en papier sans le secours des procédés chimiques ci-après désignés.

Seconde opération—procédés chimiques.

Cette opération consiste à faire ramollir les matières effilochées
959 en les débarrassant de leur gluten et la résine qu'elles contiennent; pour y parvenir, on les fait bouillir plus ou moins longtemps, sous une pression de trois ou quatre atmosphère', dans une chaudière où l'on aura introduit une petite quantité d'acide borique dissous dans de l'eau dans laquelle on a *a* fait délayer du savon ordinaire et, autant que possible, caustique.

Cette opération, pour être rendue plus efficace, peut être precédée d'une macération de la matière dans une lessive caustique composée de deux parties, l'une de sel de varech, de soude ou de potasse, l'autre d'acide borique et de chaux vive réduite en poudre.

Le' matières, étant retirées de la chaudière, sont soumises à des lavages à l'eau, pour les débarrasser de leur gluten ou résine, décomposé par les substances chimiques et l'ébullition.

La pâte ainsi produite se convertit en papier par les moyen' ordinaires.

Légende des dessins.

Pl. 26°, *a*, bâti composé de quatre montants et de traverses horizontales.

b, tambour en fonte, dans lequel se trouvent fixées dans sa lon-
960 gueur, et à des distance' assez rapprochées, diverses lames dentellées analogues à nos scies ordinaires.

c, arbre moteur, sur lequel est fixé le tambour.

d, pignon commandant la roue en fonte *e*, qui communique le mouvement à l'arbre placé sur le derrière du tambour.

g, roue conique en fonte, placée sur l'arbre de la roue et commandant la roue *h*, fixée sur l'arbre *i*.

j, vis sans fin, placée sur l'arbre *i* et donnant le mouvement à la roue *k*.

l, toile sans fin, sur laquelle se placent les substance' destinées à être râpées. La matière, avant d'être mise en contact avec la râpe *b*, passe sous deux cylindres cannelés *o'*, superposés, recevant leur mouvement de la roue *k*, sur l'axe de laquelle l'un d'eux est fixé.

m, rouleau en bois, sur lequel vient s'enrouler la toile, et commandé par un pignon, placé sur l'axe du pignon cannelé, *o'*.

m', autre rouleau en bois, de même diamètre que précédent, et servant également à conduire la toile sans fin.

961 *h*, roue d'engrenage, placée sur l'arbre de la roue *e*.

q, brosse, servant à d'égager la râpe des filaments qui pourraient engorger les dents des lames qui la garnissent.

r, levier, portant à son extrémité un poids et exerçant de la sorte une certain' pression sur le cylindre supérieur.

s, pièce en fonte, servant de point d'appui au roseau, pour faciliter l'opération.

962 EXHIBIT No. 44.—R. E. S. *Examiner*, &c.

6399. March 12th, 1839. Mr. Moinier Legour, Paris. Translation.

6399. *Patent for five years, dated March 12th, 1839, to Mr. Moinier Legoux, of Paris, for the manufacture of paper-pulp from every kind of wood previously reduced to chips, bark, roots, leaves, grass, plants, reeds, tuberculous, leguminous root-pulp, wheat-straw, hay, grasses, mosses, water-grasses, marine-plants, and finally all vegetables of whatever nature they may be, the whole by means of mechanical apparatus and chemical processes newly applied.*

The said pulp to be used in the manufacture of paper of every kind, common pasteboard and double pasteboard.

The object of this patent is the application of the mechanical and chemical processes which are hereinafter designated, for the purpose of converting into pulp suitable for the manufacture of paper, the substances of which mention has been above made.

DESCRIPTION.—1ST OPERATION.—MECHANICAL PROCESS.

963 The first operation, which consists in reducing to fibre the substance intended for the manufacture of pulp, is effected by the aid of the machine of which the description and the plans are seen in plate 26.

It is sufficient to spread the substances upon on endless cloth which conducts it to fluted cylinders; these deliver it to the *the* rasp-cylinder in proportion as they receive it; they retain it in case the rasp should tend to draw it in. As soon as it comes in contact-with the teeth of the rasp, it is instantaneously reduced to fibres of greater or less length. This machine is designed as one of the means by which all the substances mentioned at the head of this specification can be reduced to a kind of a tow resembling the half-stuff obtained from rags. Another process for which the inventor claims also protection, at least to his application to the manufacture of paper-pulp, is to cut the substance to lengths of 15 to 20 centimetres, then to subject it to the action resembling those used in working cotton when it comes pressed from the bales; this machine consists of one, two, or three cast-iron drums, provided

964 with iron teeth, revolving at a great velocity and passing between other stationary teeth secured in cast-iron traverses placed upon the exterior of the drum, the pieces of the materials while passing between the rows of teeth will be divided into fibres and will give the desired product. To this machine there may be a feeding cloth and a mechanisme to open and close, at required intervalls, the gates by which the substance enters the machine or leaves it as half-stuff.

Instead of this machine, stampers may be substituted or the cylinder-engines usually employed in paper-making.

There might be probably also other mechanical means by which the substance could be reduced to half-stuff, but in this state it would still not be fit to be converted into paper without the aid of the chemical processes hereafter designated.

2D OPERATION.—CHEMICAL PROCESS.

This operation consists in softening the cut substances by freeing them of their gluten and of the resin which they contain. For this purpose they are boiled for a longer or shorter time, under a pressure of three to four atmospheres, in a boiler in which there shall have
965 been introduced a small quantity of boracic acid dissolved in water in which there has been mixed common soap, as caustic as possible.

To render this operation more effective, it may be preceded by a maceration of the substance in a caustic lye composed of two parts of kelp, soda, or potash, the other of boracic acid and of quick-lime reduced to powder.

The substances having been withdrawn from the boiler are then washed with water in order to free them from their gluten or resin decomposed by the chemicals and the boiling.

The pulp thus obtained is converted into paper by the usual means.

966 DESCRIPTION OF THE DRAWINGS.

Plate 26. A frame composed of four vertical legs, and of horizontal cross-pieces.

b. Cast-iron cylinder, in which are firmly secured along its total length, at distances suffisantly close together, toothed-plates similar to our common saws.

c. Driving-shaft on which is secured the cylinder.

d. Pinion driving the cast-iron wheel *e*, which communicates the motion to a shaft placed behind the cylinder.

g. Cast-iron bevel gear, placed on the shaft of wheel *e* and driving-wheel *h*, secured to the shaft *i*.

j. Screw without end fastened on shaft *i* and giving motion to a wheel, *k*.

l. Cloth without end on which are placed the substances to be rasped. The material passes, before it comes in contact with the rasp-cylinder *b*, through two fluted cylinders, *o o'*, placed one above the other, receiving their motion from the wheel *k*, on the shaft of which one of them is secured.

967 *m*. A wooden roller, around which rolls the cloth, moved by a pinion secured to the shaft of the fluted pinion *o'*.

m'. Another wooden roller of the same diameter as the former, serving also to guide the endless cloth.

h. Gear-wheel, placed on the shaft of the wheel *e*.

q. Brush, serving to free the rasp-cylinder of the fibres which would clog the teeth of the blades with which it is supplied.

r. Lever carrying a weight on its end, acting so with a certain pressure on the upper roller.

s. Cast-iron piece serving as a support to the reed-grass to facilitate the operation.

968

969 MAY 28, 1867.—Present, Messrs. Harding and Wallace.

MR. BURGESS, produced on part of the respondents, being sworn, said:

1. Q. Have you visited England recently; and if so, did you, while there, see Mr. Charles Watt?

(Question objected to by Mr. Wallace.)

A. I did visit England, and there saw Mr. Charles Watt.

2. Q. Was the Watt & Burgess patent of 1853, enrolled in 1854, ever introduced into practical operation in England, or were licenses ever granted under it?

(Question objected to.)

A. Works were put up and the process commenced on a small scale. Owing to a misunderstanding between the gentlemen en-
970 gaged in it, the operation fell through. This happened in two instances. No licenses have been granted to work the process in England. I would add that, owing to Mr. Watt's advanced years, he was personally able to move but little in the matter, and this, as I understand, was the principal cause of failure.

3. Q. When were those operations commenced which fell through?

(Question objected to.)

A. I am unable to give the dates, but I believe that the two attempts to start the process had perhaps an interval of three years between them. The first attempt, as near as I can recollect, was in 1854 or 1855, probably the summer of 1854; but of this I am not certain.

4. Q. By whom were the second operations which fell through undertaken?

(Question objected to.)

A. I do not know the names of any of the parties, as I left the matter in the hands of Mr. Charles Watt entirely.

5. Q. Was any paper ever made under this patent in England; and if so, how much, and what amount of money was in any way realized from the English patent?

(Question objected to.)

A. Some hundreds of pounds of paper were made at Boxmore, in 1853 or 1854. This might have been previous to the granting of the patent. I am not aware as to the amounts of paper, if any, since the granting of the patent, that have been made in England. My impression is that some quantity has been made since the granting of the patent. I am not aware of any money having been received for the same patent in England; at any rate, I have received none from that source.

6. Q. What do you mean by the expression some quantity? And state where and by whom the paper to which you allude was made.

A. I am under the impression that perhaps a ton or more paper was made; but I am quite ignorant of the detail of the facts as to how and where it was made.

7. Q. Are you not aware that in England an immense amount of paper has been made by boiling Esparto grass in caustic alkali under pressure?

971 (Question objected to by Mr. Wallace, who instructed the witness he was only to answer from his own knowledge.)

A. I have heard that large quantities of paper are made in England from Esparto grass, by boiling it in caustic alkali, under pressure.

(Answer objected to by Mr. Wallace.)

8. Q. Did you or Mr. Watt ever assert any legal claim or right against parties in England making pulp or paper by treating Esparto grass in caustic alkali, under pressure?

(Question objected to.)

A. We have not.

9. Q. Are you aware that pulp has been made in England, in considerable quantities by boiling straw in caustic alkali, under pressure?

(Question objected to by Mr. Wallace, who again instructed the witness to answer only from his own knowledge.)

A. I have heard that large quantities of straw are converted into pulp and paper by boiling straw in caustic alkali, under pressure, in England.

10. Q. Has any legal claim ever been asserted, on part of your patent, against any such parties?

(Question objected to.)

A. There has not.

11. Q. what amounts have Mr. Watt and yourself realized, directly or indirectly, from the American patent, granted to you in 1854, or from either of the re-issues thereof?

(Question objected to by Mr. Wallace as impertinent, who also instructed the witness that he had a right, if he chose, not to answer it?)

A. I have already answered the question in my previous cross-examination, when called as a witness for the complainants, in my answer to question 143, where I state I believe my share was about two thousand pounds, received from H. B. Houghton in the shape of his notes, some of which have not been paid.

12. Q. Is that the fullest and most precise answer which you can now make to that question?

A. I can give from the book, which I hold in my hand, the exact amounts of the cash paid me, and the notes given for the purchase
972 of the Watt & Burgess patent. It was as follows: I received in cash, from Mr. Houghton, six hundred and seventy-five pounds, and subsequently cash or drafts to the amount of one hundred and fifty pounds, and Mr. Houghton's note of hand, at eighteen months, for one thousand five hundred and sixty-two pounds and ten shillings; also his note, at nine months, for nine hundred and thirty-seven pounds and ten shillings, which two notes I remitted to Mr. Watt. I also received two notes, at nine and eighteen months, for my share of the purchase of the patent, which are not down in the book I hold. The total amount of the purchase-money was five thousand pounds. The book to which I refer above, is the Testimony and Exhibits of the American Wood-Paper Company vs. The Fibre Disintegrating Company, in my testimony given in that case, in answer to questions 25 and 26 of my cross-examination.

13. Q. Did you not, within the last two weeks, file a statement of the exact amount realized by you and Mr. Watt of all you had received from the American patent?

(Question objected to by Mr. Wallace, who said if there be such a statement it should be produced.)

A. I did.

14. Q. What amount did you allege there that Mr. Watt and yourself received?

(Question objected to by Mr. Wallace, on the same ground.)

A. To the best of my recollection, I stated that Mr. Watt received six hundred and fifty pounds, and I received one hundred and eighty-six pounds. I believe those were the amounts. I copied them directly from my account-book, and do not remember the precise figures.

15. Q. Have you not had an interest of one-third in the Ladd & Keen re-issues, prior to and since their grants of 1858 and 1863?

(Question objected to by Mr. Wallace as impertinent and irrelevant, and the witness instructed as before.)

A. Messrs. Ladd & Keen gave me about one-third share, in consideration of my remaining in this country and aiding them in working the patents.

16. Q. What amount have you realized from the Ladd & Keen re-issues?

(Question objected to by Mr. Wallace for the same reasons as above.)

973 A. I realized my share in the stock of the American Wood-Paper Company, namely, about nine hundred and sixteen shares of the stock, at a par value of one hundred dollars per share, and a salary as chemist.

17. Q. Prior to the organization of the American Wood-Pulp Company, and the receipt of that stock by you in 1863, you realized nothing from the re-issues to Ladd & Keen?

(Question objected to by Mr. Wallace.)

A. Not that I remember.

18. Q. Did you consent, as a stockholder, to the purchase of the Mellier patent, or did you oppose the purchase in any way?

(Question objected to by Mr. Wallace.)

A. I neither opposed nor acquiesced, as I did not attend any of the meetings in which that subject was discussed.

19. Q. State, as near as you can, about what amount of stock was given for that patent.

(Question objected to by Mr. Wallace.)

A. I do not know anything at all relating to the purchase of the Mellier patent.

20. Q. Who would know, who is connected with your company?

A. The officers of the company, I suppose.

21. Q. When did you last boil pine or other woods containing resinous matter in caustic alkali of a strength of ten to twelve degrees English hydrometer, in the process of making pulp?

(Question objected to.)

A. I am unable to answer that question.

22. Q. State, as near as you can, when you last used, in practical operation, that degree of the hydrometer in treating resinous woods in caustic alkali?

(Question objected to by Mr. Wallace.)

A. I think in 1862 or 1863, we boiled some lots of pine with weak alkali. I cannot remember the exact strength. I only know about that time I boiled some in weak alkali, but of what strength I do not now know.

23. Q. Did it make pulp by boiling it in this alkali?

A. I do not remember the precise condition in which the wood came from the boiler.

974 24. Q. When did you last boil resinous wood in caustic alkali, and then submit it to the action of chlorine, or its compounds, with oxygen, and then to a weak solution of caustic alkali, and, fourthly, bleach it by the ordinary method of bleaching?

A. In the spring of this year (1867) we treated resinous wood in this manner, using hypochlorite of lime in place of bleach-powder. It may have deen done since then, but not to my knowledge.

25. Q. What amount of wood have you treated in that way, by submitting it to those four operations in succession?

A. Only a small proportion of the quantity used by us; perhaps from four to six per cent.; somewhere about there.

26. Q. Has the bulk of resinous wood treated by you been pulped by boiling in caustic alkali alone; and if so, at what pressure and strength of solution by the English hydrometer? I mean at your works in practical operation in this country.

A. The greater bulk of resinous wood has been pulped by boiling in caustic alkali, at a pressure from one hundred and forty to one hundred

and sixty pounds, at seventeen English hydrometer. This varies with the age of the wood, young wood requiring less strength.

27. Q. What per centage of resinous wood do you mean by greater bulk, and what wood have you found to resist boiling in caustic alkali alone?

A. The percentage would be from ninety-four to ninety-six per cent. of resinous wood. I do not, at the present moment, remember any wood that will not pulp if sufficient pressure, time, and alkalies are given to it.

28. Q. What kind of wood is this four to six per cent. of wood, to which you have alluded, and how does it differ from the other resinous wood?

A. The wood alluded to as being part of the four to six per cent., was mostly old resinous wood—hemlock and pine, and some little cedar, and also a small proportion of non-resinous wood, as poplar, gum, hickory, and walnut.

29. Q. Why did you have to submit these woods to the three-stage process? Was it because, after pulping them and bleaching them in the usual way, you found the color not good? Did you boil them in caustic alkali, under pressure, and bleach them a second time?

A. In some cases this was so; in others we could not properly
975 prepare the pulp except by the three-stage process. By prepare, I mean render the pulp sufficiently soft and pliable.

30. Q. How often did that occur, and where last, and with what wood?

A. Latterly but very seldom, as we avoided using the woods that entail this process, these woods being very old resinous woods, as pine, cedar, and hemlock, or slow-growing hickory and walnut.

31. Q. What percentage of resinous wood have you, in your practice, found to demand the tri-stage process?

A. I am unable to give a definite answer to that question; but the quantity of resinous wood so treated might be about one to two per cent. of all the resinous wood treated by us.

32. Q. Are you willing to state positively that, since 1856, you have boiled resinous woods in a solution of caustic alkali as low as twelve degrees, English hydrometer, and then treated it with chlorine or its compounds, with oxygen, and then with a weak solution of warm caustic alkali, so as to pulp it, prior to bleaching?

(Question objected to by Mr. Wallace.)

A. I believe we have only done this in one or two instances since 1856.

33. Q. When and to what extent, and why was it so done?

A. I cannot give the time. I do not think we have used this process more than two or three times. I forget the precise object for which this was done. I merely recollect its being done.

34. Q. Then, in practice, the treatment of resinous woods, as described in my last question, has been abandoned by you in your practical operations since 1854? My question refers to the condition of the caustic alkali, and the subsequent treatments as mentioned in my thirty-second question.

A. If you refer to the strength of the alkali as low as twelve degrees, English hydrometer, it has been practically abandoned by us since 1854.

35. Q. Has not your practice been to boil resinous woods in caustic alkali, as strong or stronger than non-resinous woods, and in ninety-eight per cent. of the cases to pulp it by the direct action of caustic alkali?

(Question objected to by Mr. Wallace.)

A. It has.

976 36. Q. With non-resinous woods have you resorted, in practice since 1854, to this process, mentioned in my thirty-second question?

A. Only very seldom.

37. Q. And has it been practically abandoned since 1854, in reference to non-resinous woods? I mean the process as set out in my thirty-second question.

A. It has been practically abandoned, because we endeavor to discard those non-resinous woods requiring the tri-stage process.

38. Q. Have you ever, since 1854, treated non-resinous woods as mentioned in the thirty-second question?

A. I do not remember having treated non-resinous woods in the process referred to, since 1854, more than once or twice at a strength of alkali as low as twelve degrees, English hydrometer.

39. Q. What is the minimum strength of alkali used by you, since 1856, in your practical operations?

A. About fourteen degrees, English hydrometer, for non-resinous, and about seventeen to eighteen for resinous.

40. Q. In practical operation will a strength of twelve degrees, English hydrometer, be sufficient for resinous woods, by the single-stage process?

A. With young resinous woods under a pressure of, say from one hundred and sixty to one hundred and eighty pounds, a pulp will be produced, but it would not be a pure pulp.

41. Q. What would be the effect of treating resinous woods, of the ordinary character, at twelve degrees, English hydrometer, and at three hundred degrees temperature? Would it pulp it; and if so, to what extent?

A. A rough pulp, but not a pure pulp, would be obtained after long boiling.

42. Q. How long?

A. From sixteen to eighteen hours, perhaps.

43. Q. Would the pulp produced be such a result as your patent contemplates?

A. Not unless followed by the three-stage process.

44. Q. Then boiling resinous woods in caustic alkali, under pressure, at a temperature of three hundred degrees, and a strength of solution of twelve degrees English, would not be within your invention, if not subsequently treated by chlorine and a dilute solution of caustic alkali?

977 (Question objected to by Mr. Wallace.)

A. No; I do not think it would.

45. Q. In boiling non-resinous woods, what is the minimum strength of alkali, English hydrometer, which must be used at three hundred degrees of temperature to produce the result which your invention contemplates? I mean what you call good pulp.

A. With very young wood, perhaps a strength of seventeen degrees, English hydrometer, would produce a pulp contemplated in my invention, at a temperature of three hundred degrees, propprovided a large quantity of the alkaline solution was used.

HUGH BURGESS.

978–9 DEFENDANTS' EXHIBIT NO. 1.—*Record-book of Hugh Burgess.*

BOILING ACCOUNT.

Date.	Stock.	Kind.	Alkali. Gallons.	Hydro. Beaume.	Pounds of Soda-ash.	Remarks.
1856.						
April 29	1,286	Straw	700	8¼	371	
" 30	3,244	Maple	1,150	11	1,582	Done 3 hours at 175.
May 1	1,260	Straw	500	10	625	Not done.
" 2	2,970	Maple	1,000 / 510	10 / 11	1,251 / 687	Not done first boiling.
" 5	3,128	Poplar	1,500	11	2,063	
" 9	1,230	Straw	750	10	937	
" 11	1,600	"	950	11	1,305	
" 12	4,326	Poplar	1,250	7	1,094	
	658	Straw	600	1	374	Not done first boiling.
	4,984		1,800			
" 17	4,369	Poplar				
	525	Straw				
	4,894		1,550	9	1,743	Done.
" 19	4,336	Hickory	1,610	10	2,000	
	525	Straw				Done.
	4,861					
" 19	4,389	Poplar	1,300		1,788	
	500	Rope	500	11	437	
	4,889		1,800	7		Charge well done.
" 22	3,514	Poplar				
	525	Straw	1,800	7	1,236	
	4,039					
" 22	1,200	Straw	1,200	11		[bleach.
June 26	1,980	Cedar	1,450	8	1,450	Boiled 24 hours; would not
" 27	2,569	Cedar	550	8	550	Not quite done; would not
		Rail	750	6		bleach.
			475	8	475	
" 28	1,700	Flax	800	7		Shive not done.
July 1	3,465	Poplar	550	6	412	
	494	Flax	2,300	7	2,012	Shive not done.
	3,959		2,850		2,424	
	5,678	Poplar	1,350	9	1,518	
980			500	10	625	
			800	5	497	This charge was water-log-
July 2			500	10	675	ged, and the liquor was
					625	discharged and fresh put in.
					3,940	
	6,482	Poplar	700	10	875	
			450	9	281	
" 5			1,850	10	2,312	
					3,468	
	4,919	Poplar	1,950	10	2,437	
" 7	500	Rope				Well done.
	5,419					
" 10	1,990	Flax	1,000	10	1,250	Overdone.
" 11	3,000	Cedar	2,000	10	2,500	Overdone.
" 14	1,137	Straw	600	11	824	Well done.
	1,400	"	1,050	10	1,313	
" 14	846	Poplar				Well done.
	2,240					
	4,133	Poplar	1,400	10	1,750	
" 15	700	Straw	150	8	150	Not done, nearly all black ash. Liquor.
	4,833				1,900	
	500	Rope	850		1,062	
" 17	540	Straw				Charge well done
	1,040					
	3,976	Poplar				
	600	Straw	1,650	8	1,650	
" 18	150	Rope				Not quite done, liquor exhausted.
	4,726					

DEFENDANTS' EXHIBIT NO. 1.—*Record-book of Hugh Burgess.*

BOILING ACCOUNT—(Continued.)

Date.	Stock.	Kind.	Alkali. Gallons.	Hydro. Beaume.	Pounds of Soda-ash.	Remarks.
1856.						
" 19	3,181	Poplar	1,200	12	1,794	Well done except end chips.
	300	Rope	175	9		
	555	Straw				
	4,036					
" 19	1,316	Poplar				Well done.
	200	Rope	1,000	9	1,125	
	720	Straw				
	2,236					
" 21	1,360	Straw	650	10	812	(Black ash.)
	170	Rope	175	7	113	Well done, liquo not quite exhausted.
	1,530				925	
981						
July 22	1,300	Straw				Well done.
	170	Rope	325	12	487	
" 23	4,600	Dry pop				Not done; liquor exhausted; added fresh liquor; all done but shive and knots
	210	R'e & F'x.	750	10	937	
	375	Straw	750	10	937	
	5,185				1,874	
" 23	1,300	Straw				Shive not done; reboiled on 24th.
	250	Flax	450	10	499	
	1,550					
" 24	Above charge.					
" 25	1,080	Straw	300	10	375	Shive not done.
" 25	1,525	"	300	10	375	Not quite done.
" 25	1,260	"	300	10	375	Done.
" 25	1,170	"	500	8	500	Done.
" 25	2,374	"	950	8	950	Charge done in three hours.
	3,005	"	325	5	202	
" 28	200	Rope	275	8	275	Not quite done.
			500		218	
	3,205		175	10	187	
" 28	1,493	Straw	425	10	531	Done.
	3,086	Poplar	525	10	656	
" 29	200	Rope				About 1½" well done.
	3,285		576	11	789	
	3,173	Poplar	700	11	962	
	200	Rope	150	3	55	
" 30			150	3	55	Pulp, none allowed for rope; boiled 15 hours; well done; rope overboiled.
	3,373		250	11	343	
					1,415	
	3,430	Poplar	600	12	900	
	150	Rope	640	6	487	
" 30			250	7	218	About 1½" to 1" wood-pulp; liquor good; stock well-done.
	3,580					
					1,605	
	3,395	Poplar	950	10	1,187	
	150	Rope			and some	
" 31					weak	Well done; 1" to 1" of wood-pulp.
	3,545				heading	
					liquor.	
	3,598	Poplar	1,100	8	1,100	
	784	Straw	150	3	75	
Aug. 2			20	1	125	Not quite 1" to 1" pulp well done; liquor good.
	4,382					
					1,300	
982.						
" 3	1,450	Rope	1,500	1	187	Liquor exhausted; shive not done; re-boiled Aug. 9.
			8			
" 4	5,232	Poplar	850	9	955	Liquor good; well done; not at 1" to 1" of pulp.
			350	12	480	
					1,435	
" 5	3,465	"	550	11	825	Not 1". to 1" of pulp well done.
			200	4	100	
					925	

DEFENDANTS' EXHIBIT NO. 1.—*Record-book of Hugh Burgess.*

BOILING ACCOUNT—(Continued.)

Date.	Stock.	Kind.	Alkali. Gallons.	Hydro. Beaume.	Pounds of Soda-ash.	Remarks.
1856.						
	5,264	"	650	12	975	(Not caustic.)
			325	10	406	
" 6			300	6	225	A few black specks of undone stock; not a good head of steam.
					1,606	
" 8	1,918	Bass	375	11	514	Well done.
	4,473	Poplar	550	.....	687	
" 8			600	.....	374	Well done.
					1,061	

983

Date.	Stock.	Kind.	Alkali. Gals.	Hydro. Beaume.	Pounds of soda-ash.	Proportion.	Remarks.
1856.							
Aug. 8	2,625	Poplar	500	750	750		Liqour exhausted; well done.
			Hdg. lq'r.				
	2,625	"	500	12	750		
" 8			Hdg. lq'r.				
			50	12	75		Liquor good; well done.
					825		
" 9		Rope reboiled.	100	9	112		
	5,292	Poplar	1,050	9	1,181		
			600	9	674		
" 11					1,855		Well done.
	2,884	Poplar	700	9	787		
" 11			350	4	125		Liquor exhausted; reboiled.
			150	10	187		
" 12	1,917	Flax	700	10			Not done by 1st or 2d liquor; by 3d liquor the flax was hot; the shive not done.
			375	12			
" 13	1,890	Straw.....	750	12			Not done by first quantity; B. A. was the ash used.
" 15	1,500	Rope.....	375	12			Not done by first liquor.
" 16	5,768	Poplar	1,850	12			Well done.
	1,685	Straw.....	900	7			
" 18	344		150	12			Well done.
	2,029						
	2,128	Poplar	700	12			
" 18	1,683	Straw.....	850	12			Well done.
	3,811						
	4,957	"	700	12		15	Not done by first quantity of liquor; not done by 2d; this was in No. 2 boiled.
" 19			600	10			
			250	10			
	2,203	"	800	10		15	Not done by 1st quantity of liquor; added fresh ch'ge of straw; not done; 3d liquor finished the charge.
" 19	1,376	"	600	10		13	
	3,579		500	6			
" 19	3,584	Poplar	1,750	11	N. C.	13	An error was made in the calculation of the wood; too much alkali.
			200	14			
984 Aug. 21	4,000 undone straw.	"	1,500	12			Allowance made for undone straw; liquor quite good.
	3,138	Straw.....	550	14	N. C.		
" 22	100	Rope.....	550	12		13	Allowance made for rope, liq'r good.
	3,208						

DEFENDANTS' EXHIBIT NO. 1.—*Record book of Hugh Burgess.*

BOILING ACCOUNT—(Continued.)

Date.	Stock.	Kind.	Alkali. Gals.	Hydro. Beaume.	Pounds of soda-ash.	Proportion.	Remarks.
" 22	1,217	Rope.....	400	8		17	Well done; the hdg. liq'r was good.
			Hdg. liquor. S.				
	5,040	Poplar	750	8	N. C.	11½	Allowance made for N. C. liquor; well done; liquor good but too strong.
" 23	862	Straw.....	1,950	11			
	5,902						
	1,680	Poplar	750	10		11	Well done.
" 23	1,416	Straw.....	900	7			
	3,096						
	2,000	Poplar	950	12		12½	Well done.
" 25	1,923	Straw.....	500	10			
	3,923						
	4,400	Poplar	700	10		12	Well done.
" 26	1,064	Straw.....	1,200	13			
	5,464						
	2,000	Poplar	850	8		12	Well done; liquor exhausted.
" 27	2,017	Straw.....	900	11			
	4,017						
	2,000	Poplar	1,200	12	B. A.	9	Well done; liquor quite good.
" 28	2,066	Straw.....	800	11			
	4,066						
	(1)						
	1,000	Poplar	1,550	9		12	Well done; liquor exhausted.
" 28	2,221	Straw.....					
	3,221						
	(2)						
	1,000	Poplar	400	9		10	Well done; liquor good.
" 29	3,057	Straw.....	1,300	13	B. A.		
	4,067						
	(1)						
	1,344	Poplar	150	13	B. A.		
" 30	1,967	Straw.....	550	8		16	Well done; liquor exhausted.
	3,311		750	6			
	(2)						
985	3,005	Straw.....	755	6			
Sept. 1	1,344	Poplar	1,050	10		13	Well done.
	4,349		500	5			
	(No. 1.)						
	3,478	Straw.....	1,400	12	B. A.	11½	Well done.
" 2	1,344	Poplar	700	6			
	4,822						
	(No. 2.)						
	2,902	Straw.....	750	7			Not done; weak liquors do not seem to be so effective, though the number of degrees may be made up.
	1,000	Poplar	450	4			
" 2			400	5			
	3,902		550	12			Well done.
	(No. 1.)						
	3,159	Straw.....	200	10			
" 3	1,120	Poplar	1,250	12½	B. A.	13½	Well done.
	4,279						
	(No. 3.)						
	3,019	Straw.....	750	12			Well done; liquor exhausted.
			450	9			
			150	11			
	3,001	Straw.....	1,350	11	B. A.		Well done; liquor exhausted.
	214	"					
	3,215						
" 6	2,533	"	450	9			Well done; liquor exhausted.
			900	10			
" 8	3,007	"	350	10			Well done; liquor exhausted.
			900	10			

DEFENDANTS' EXHIBIT NO. 1.—*Record-book of Hugh Burgess.*

BOILING ACCOUNT—(Continued.)

Date.	Stock.	Kind.	Alkali. Gals.	Hydro. Beaume.	Pounds of soda-ash.	Proportion.	Remarks.
" 9	3,192	"	1,200	11			Well done; liqour good.
			150	10			
" 9	3,169	"	1,200	10			Well done; liquor exhausted.
" 10	2,994	"	750	7			Well done; liqour exhausted.
			1,150	8½			
" 10	2,102	"	1,000	6			Well done; liquor exhausted.
			750	5			
" 10	3,104	"	1,000	9			Well done; liquor exhausted.
			450	10			
" 11	2,185		1,050	8			Well done; liquor exhausted.
			450	6			
" 12	2,844		900	8½			Fairly done; liquor nearly exhausted.
			356	6			
			250	5			
" 13	1,235		bl'k	l'qr			Well done.
" 13	3,459		900	11			Well done.
986			700	6			
" 15	3,178		750	12			Well done.
			800	6			
" 15	2,896		1,050	11			Well done.
			450	6			
Sept. 16	3,073		650	6			Well done.
			1,100	9			
" 16	2,499		1,050	9			Well done.
			200	9			
" 17	3,084		1,000	12			Well done.
			150	6			
" 17	2,541	Straw.....	900	6			Well done.
	75	Bag.....	850	8			
" 18	2,616	"	750	13			Well done.
	3,307		550	5			
	3,128	"	650	5			Not done; added fresh liquor.
" 18			500	13			
			500	6			
" 19	3,150	"	1,250	11			Well done.
			200	10			
" 19	3,006	"	650	11			Not done; added fresh liquor.
			600	9			
Nov. 10	2,800	"	1,000	11			Well done.
" 11	2,700	"	1,200	10			Well done.
" 12	3,355	"	1,300	10			Well done.

987

1856.

Nov.	13.	3,147	bagging.	"	"	3,028 "
"	"	3,442	"	"	21.	3,059 "
"	14.	3,147	"	"	"	3,009 "
"	15.	2,577	"	"	22.	3,030 "
"	"	2,548	"	"	"	3,100 "
"	17.	2,506	"	"	24.	3,084 "
"	"	2,507	"	"	"	3,034 "
"	"	2,561	"	"	25.	2,595 "
"	18.	2,614	"	"	"	3,074 "
"	"	2,564	"	"	"	2,503 "
"	"	2,540	"	"	26.	2,573 "
"	19.	2,533	"	"	"	2,519 "
"	"	3,042	"	"	27.	2,589 "
"	"	3,131	"	"	"	2,538 "
"	"	3,090	"	"	28.	2,544 "
"	20.	3,060	"	"	"	2,587 "
"	"	3,090	"	"	"	2,587 "
				"	29.	2,669 "
				"	"	2,536 "
				"	"	2,542 "

Dec.	1.	5,089	"
"	2.	2,524	"
"	"	2,598	"
"	"	2,539	"
"	"	2,542	"
"	3.	2,526	"
"	"	2,552	"
"	"	2,544	"
"	"	2,517	"
"	4.	2,552	"
"	"	2,520	"
"	5.	2,511	"
"	"	2,533	"
"	6.	2,585	"
"	"	2,539	"
"	"	2,502	"
1856.			
Dec.	8.	2,536	bagging.
"	"	2,531	"
"	"	2,513	"
"	"	2,546	"
"	9.	2,522	"
"	"	2,558	"
"	"	2,569	"
"	10.	2,500	"
"	"	2,526	"
"	"	2,533	"
"	11.	2,545	"
"	"	2,518	"
"	12.	2,500	"
"	13.	2,524	"
"	"	2,500	"
"	15.	2,513	"
"	"	2,518	"
"	"	2,509	"
"	16.	2,528	"
"	"	2,507	"
"	"	2,500	"
"	17.	2,500	"
"	"	2,510	"
"	"	2,507	"
"	18.	2,526	"
"	"	2,540	straw.
"	"	2,519	"
"	19.	2,500	"
"	"	2,513	"
"	"	2,539	"
"	20.	2,513	"
"	"	2,554	"
"	22.	2,504	"
"	"	2,508	"
"	23.	2,569	"
"	"	2,513	"
"	"	2,533	"
"	"	2,574	"
"	24.	2,516	"
"	"	2,550	"
"	27.	2,571	"
"	"	2,534	"
"	29.	2,505	"
"	30.	2,534	"
"	"	2,558	"
"	31.	5,558	"
"	"	2,531	"
"	"	2,528	"
1857.			
Jan.	1.	2,538	straw.
"	2.	2,562	"
"	3.	2,553	"

988

1857.			
"	3.	2,556	straw.
"	5.	2,536	"
"	6.	2,519	"
"	7.	472	rag.
"	12.	865	"
"	13.	3,054	straw.
		300	rope.
		3,354	
"	14.	3,018	straw.
		300	rope.
		3,310	
"	14.	2,505	straw.
		200	rope.
		2,705	
"	15.	3,088	straw.
		200	rope.
		3,288	
"	15.	3,041	straw.
		200	rope.
		3,241	
"	16.	3,068	straw.
		200	rope.
		3,268	

"	16.	3,026	straw.
		200	rope.
		3,226	
"	19.	250	rope,(old charge.)
"	20.	3,060	straw.
		131	
		3,191	
"	20.	457	rag.
"	21.	2,500	straw.
"	21.	650	rag.
"	22.	2,500	straw.
"	22.	2,500	"
"	23.	2,500	"
"	24.	1,696	rag.
"	26.	2,000	straw.
"	30.	1,185	rope.
"	30.	2,559	straw.
"	30.	2,553	"
"	31.	2,552	"
"	31.	2,578	"
1857.			
Feb.	2.	6,052	straw.
"	3.	2,595	"
"	4.	3,042	"
"	4.	3,006	"
"	5.	3,000	"
"	6.	5,590	"
"	9.	3,005	"
"	10.	3,082	"
"	10.	2,500	"
"	11.	3,000	"
		118	flax
		3,118	
"	12.	3,000	
		122	flax.
		3,122	
"	13.	1,572	wood.
		97	bagging.
		1,669	
"	14.	3,000	straw.
		61	flax.
		3,061	
"	16.	3,000	straw.
		97	flax.
		3,097	
"	16.	3,000	straw.
		104	flax.
		3,104	
"	17.	3,000	straw.
		62	flax.
		3,062	
"	18.	3,000	straw.
		200	bagging.
		3,200	
"	18.	3,000	straw.
		200	manilla.
		3,200	
"	19.	3,000	
		180	rope.
		3,180	
989			
1857.			
Jan.	19.	3,000	
		180	rope.
		3,180	
"	21.	3,000	straw.
		200	rope.
		3,200	
"	24.	2,500	straw.
		170	rope.
		2,670	
"	25.	2,500	straw.
		170	rope.
		2,670	

"	26.	2,500	straw.
		62	bagging.
		2,562	
"	27.	2,500	
		42	bagging.
		2,542	
"	27.	2,500	
		49	bagging.
		2,549	
"	28.	2,500	
		280	rope.
		2,780	
"	28.	2,500	
		170	rope.
		2,670	
Mar.	2.	2,500	straw.
		170	rope.
		2,670	
"	2.	2,500	straw.
		170	rope.
		2,670	
"	2.	2,500	straw.
		170	rope.
		2,670	
1857.			
Mar.	3.	2,500	straw.
		170	rope.
		2,670	
"	4.	2,500	straw.
		170	rope.
		2,670	
"	4.	1,225	straw.
		170	rope.
		1,225	wood.
		2,620	
"	5.	1,225	straw.
		1,225	wood.
		170	rope.
		2,620	
"	5.	2,500	straw.
		170	rope.
		2,670	
"	6.	2,500	
		170	
		2,670	
"	6.	2,500	straw.
		170	rope.
		2,670	
		2,500	straw.
		170	rope.
		2,670	
"	7.	2,500	straw.
		170	rope.
		2,670	
"	9.	2,500	straw.
		170	rope.
		2,670	
"	9.	2,500	wheat.
		170	rope.
		2,670	
"	10.	2,500	wet straw.
		170	rope.
		2,670	

990

1857.

Mar.	10.	2,500	wet straw.
		170	
		2,670	
"	11.	2,500	wet straw.
		170	rope.
		2,670	
"	11.	2,500	wet straw.
		170	rope.
		2,670	
"	12.	2,500	rag-straw.
		170	rope.
		2,670	
"	12.	2,500	straw.
		170	rope.
		2,670	
"	13.	1,323	wood.
		50	rope.
		1,373	
"	13.	2,500	straw.
		170	rope.
		2,670	
"	13.	2,500	straw.
		170	rope.
		2,670	
"	14.	2,500	straw.
		146	rope.
		2,646	
"	14.	900	rag, Rogers.
"	14.	2,500	straw.
"	16.	2,500	"
"	16.	2,500	"
"	17.	2,500	"
"	17.	2,500	"
"	17.	2,500	"
"	18.	2,500	"
"	18.	2,500	"
"	18.	1,000	rag, Rogers.
"	19.	2,500	straw.
		300	rope, M. Bed.
		2,800	

1857.

Mar.	19.	2,500	straw.
		170	rope.
		2,670	
"	20.	2,500	straw.
		170	rope.
		2,670	
"	20.	2,500	straw.
		170	rope.
		2,670	
"	21.	2,500	straw.
		170	rope.
		2,670	
"	21.	2,500	straw.
		170	rope.
		2,670	
"	21.	2,500	straw.
		170	rope.
		2,670	
"	23.	2,500	straw.
		170	rope.
		2,670	
"	23.	2,500	straw.
		170	rope.
		2,670	
"	24.	2,500	straw.
		170	rope.
		2,670	

"	24.	2,500	straw.
		170	rope.
		2,670	
"	25.	2,500	straw.
		170	rope.
		2,670	
"	25.	2,500	straw.
		170	rope.
		2,670	

991

1857.

Mar.	26.	2,500	straw.
		170	rope.
		2,670	
"	26.	2,500	straw.
		170	rope.
		2,670	
"	27.	2,500	straw.
		170	rope.
		2,670	
"	27.	2,600	
		170	
		2,670	
"	28.	2,500	straw.
		170	rope and bag.
		2,670	
"	28.	2,500	straw.
		170	rope and bag.
		2,670	
"	30.	2,500	straw.
		170	rope and bag.
		2,670	
"	30.	516	cotton sweepings.
Apr.	1.	2,500	straw.
		170	rope.
		2,670	
"	1.	2,500	straw.
		170	rope.
		2,670	
"	2.	2,500	straw.
		170	rope.
		2,670	
"	2.	2,500	straw.
		170	rope.
		2,670	
"	3.	2,500	straw.
		170	rope.
		2,670	

1857.

Apr.	3.	523	sweepings.
"	4.	2,500	straw.
		170	rope.
		2,670	
"	6.	2,500	straw.
		170	rope.
		2,670	
"	7.	2,500	straw.
		170	rope.
		2,670	
"	7.	2,500	straw.
		170	rope.
		170	sweepings.
		2,840	
"	8.	2,500	straw, part oats.
		100	sweepings.
		120	rope.
		2,720	

"	8.	2,500	oats and straw.
		100	sweepings.
		120	rope.
		2,720	
"	9.	2,500	oats.
		100	sweepings.
		120	rope.
		2,720	
"	9.	2,500	oats.
		100	sweepings.
		120	rope.
		2,720	
"	10.	2,500	oats.
		150	sweepings.
		80	rope.
		2,730	
"	10.	1,870	oats.
		70	rope.
		140	sweepings.
		2,080	

1857.			
Apr.	11.	1,360	oats.
		45	rope.
		95	sweepings.
		1,500	
"	11.	2,500	oats.
		40	rope.
		80	sweepings.
		2,720	
"	13.	2,500	oats.
		60	rope.
		200	sweepings.
		2,760	
"	14.	2,500	oats.
		60	rope.
		200	sweepings.
		2,760	
"	15.	2,345	poplar.
		70	rope.
		200	sweepings.
		2,615	
		794	sweepings.
"	17.	865	picker waste.
"	18.	1,800	red cedar.
		100	rope.
		100	grass bag.
		2,008	
1857.			
Apr.	20.	2,000	W. cedar.
		100	rope.
		100	bagg.
		2,200	
"	20.	1,800	R. cedar.
		70	rope.
		100	bagg.
		1,970	
"	21.	2,000	W. cedar.
		100	rope.
		100	bagg.
		2,200	
"	22.	2,100	W. cedar.
		100	rope.
		100	bagg.
		2,300	
"	23.	2,500	poplar.
		200	rope.
		2,700	
"	24.	2,500	poplar.
		200	rope.
		2,700	
"	25.	2,500	dirty straw.
		200	rope.
		2,700	
"	25.	2,500	poplar.
		200	
		2,700	

993	Straw.	Corn-stalk.	Rope.	Woolens.
1859.				
Aug. 10	1,266	.....	1,420	.....
" 12	1,373	.....	.....	.....
" 15	2,729	.....	.....	.....
" 18	1,233	.....	2,906	.....
" 19	1,268	.....	.....	.....
" 20	3,133	.....	.....	.....
" 22	"	.....	.....	4,423
" 23	3,815	.....	.....	.....
" 26	2,711	.....	.....	.....
" 27	3,582	.....	.....	.....
" 27	2,737	.....	.....	.....
" 28	3,471	.....	.....	.....
" 29	2,247	.....	.....	.....
" 29	1,571	.....	.....	.....
	31,147		4,326	4,423
Sep. 1	1,381	.....	.....	.....
" 1	2,354	.....	.....	.....
" 2	4,182	.....	.....	.....
" 3	2,677	.....	.....	.....
			Flax.	
" 6	1,062	.....	2,000	.....
" 7	3,665	2,721	.....	.....
" 10	1,461	803	.....	2,102
" 11	1,377	.....	.....	2,634
" 12	6,466	.....	.....	.....
" 13	2,584	.....	.....	.....
" 14	5,350	.....	.....	.....
" 17	4,726	.....	.....	2,709
" 19	1,359	.....	.....	.....
" 20	5,726	.....	.....	.....
" 21	6,393	.....	.....	.....
" 26	"	.....	.....	5,004
" 26	"	.....	.....	4,751
" 29	"	.....	1,766	.....
" 29	"	.....	3,365	.....
" 26	1,091	.....	3,341	.....
" 30	2,721	.....	.....	.....
	54,575	3,523	10,472	21,057
Oct. 3	2,378	.....	.....	4,163
" 4	1,835	.....	.....	3,199
" 5	2,311	.....	4,992	.....
" 6	2,489	.....	3,163	.....
" 7	2,222	.....	.....	.....
" 10	2,113	.....	.....	.....
" 11	2,337	.....	.....	.....
" 12	1,873	.....	.....	.....
" 12	2,812	.....	.....	.....
			R.	
" 13	2,324	.....	3,137	.....
" 14	2,268	.....	.....	.....
			R.	
" 15	2,304	.....	5,869	.....
	S. H.		Ta. rope	
994				
Dec. 21	2,288	.....	2,977	.....
			G.	
" 21	1,131	.....	2,942	.....
	S. H.		M.	
" 21	2,308	.....	1,086	.....
	S. H.		G. B.	
" 21	2,308	.....	3,130	.....
			G. B.	
" 23	2,962	.....	3,173	.....
			G.	
" 23	2,648	.....	3,030	.....

	Straw.	Corn-stalk.	Rope.	Woolens.
1859.				
Oct. 17	1,926	.....	.....	.....
" 18	2,703	.....	.....	.....
" 18	2,599	.....	.....	.....
" 19	4,491	.....	.....	.....
			Mlla.	
" 19	1,444	2,000	3,704	.....
			R.	
" 19	1,301	.....	4,691	.....
" 20	.....	.....	.....	.....
			G.	Bagg.
" 22	2,516	2,291	2,291	.....
" 25	1,135	.....	.....	.....
" 25	2,260	1,000	.....	.....
" 25	1,368	.....	.....	.....
" 25	1,436	.....	.....	.....
" 26	2,360	.....	.....	.....
" 26	2,076	.....	.....	.....
" 27	1,259	.....	4,329	.....
" 27	1,197	.....	.....	.....
" 31	1,240	.....	.....	.....
" 31	1,142	.....	.....	.....
	59,851	5,291	1,376	7,362
Nov. 2	1,234	.....	.....	5,191
" 2	1,229	.....	.....	.....
			Mlla.	
" 3	1,188	.....	4,304	.....
" 4	1,387	.....	.....	.....
" 7	.....	.....	4,353	.....
" 8	4,128	.....	"	3,324
			Mlla.	
" 10	.....	.....	2,900	.....
			Bgg.	
" 12	1,958	.....	1,910	.....
			Mlla.	
" 21	.....	.....	3,073	.....
" 21	.....	.....	2,540	.....
			C. B.	
" 22	1,697	.....	1,295	.....
			C. B.	
" 23	1,650	.....	3,037	.....
			C. B.	
			3,315	.....
	14,441	.....	26,727	8,515
	S. hay.		M.	
Dec. 5	3,980	.....	3,080	.....
			M.	
" 5	1,993	.....	3,060	.....
			M.	
" 6	1,082	.....	3,112	.....
			G. B	
" 8	1,370	.....	3,268	.....
			M.	
" 9	3,250	.....	3,011	.....
			M.	
" 14	7,972	.....	3,095	.....
			G.	
" 17	1,953	.....	2,926	.....
			M.	
" 20	1,338	.....	3,094	.....
	S. H.		M.	
Dec. 27	8,120	.....	5,091	.....
			Td. shrs.	
" 27	.....	.....	4,030	.....
			M.	
" 29	.....	.....	4,077	.....
			M.	
" 30	.....	.....	1,293	.....
			Ta. rope.	
" 31	.....	.....	1,909	.....
	44,703	.....	56,483	.....

995 UNITED STATES OF AMERICA,
Eastern District of New York, ss:

I, Samuel T. Jones, clerk of the circuit court of the United States, within and for the eastern district of New York, do hereby certify that the writings and documents hereto annexed are a true and full copy of the record and of all proceedings in the cause of The American Wood-Paper Company, complainants in equity, vs. The Fibre-Disintegrating Company, defendants, in said circuit court determined, including the evidence used at the hearing of said cause in said circuit court.

In testimony whereof I have hereunto set my hand and the seal, of said court this fourth day of December, A. D. 1871.

[SEAL.] SAMUEL T. JONES, *Clerk.*

996 *Bond for costs.*

Circuit court of the United States of America for the eastern district of New York, in the second circuit.

THE AMERICAN WOOD-PAPER COMPANY }
vs.
THE FIBRE-DISINTEGRATING COMPANY. }

Know all men by these presents that we, Robert W. Russell, of the city of New York, in the State of New York, as principals, and William S. R. Ogilby, of the same place, as surety, are held and firmly bound unto the American Wood-Paper Company, a corporation created by the legislature of the State of Rhode Island, in the sum of five hundred dollars, to be paid to the said The American Wood-Paper Company, its successors or assigns, for the payment of which, well and truly to be made, we bind ourselves, and each of us our and each of our heirs, executors and administrators jointly and severally, firmly by the' presents, sealed with our seals and dated this 24th day of March, 1871.

997 Whereas at a circuit court of the United States for the eastern district of New York, in the said circuit held at the city of Brooklyn, in the said district, on the 24th day of March, 1871, in a suit in equity, depending in the said court, between the said The American Wood-Paper Company, complainants, and the said The Fibre-Disintegrating Company, defendants, the final decree of said court was rendered, whereby, among other things, the bill of complaint in said suit was sustained as to the patent granted to M. A. C. Mellier, mentioned in the complaint in the said suit; and by the said decree it was adjudged and decreed that the said defendants in the said suit had infringed the said patent & should be enjoined as in the said decree mentioned; and the said The Fibre-Disintegrating Company, the defendants, thereupon, at the same term of said court at which the said decree was rendered, and in open court, prayed an appeal from so much of the said decree as sustained the said bill of complaint, and adjudged and decreed as aforesaid to the Supreme Court of the United States, to be holden at the city of Washington, on the first Monday of December, 1871, and the said appeal was allowed by the said circuit court:

998 Now, the condition of the above obligation is such, that if the said The Fibre-Disintegrating Company, defendants, shall prosecute their said appeal to effect, and answer all damages and costs if

they fail to make their appeal and plea good, then this obligation to be void; otherwise the same shall be and remain in full force and virtue.

R. W. RUSSELL,
W. S. R. OGILBY.
THE FIBRE-DISINTEGRATING COMPANY,
By R. W. RUSSELL, *President.*

Sealed and delivered, and taken and acknowledged, this 24th day of March, 1871, before me.

SAMUEL T. JONES,
U. S. Commissioner.

UNITED STATES OF AMERICA, *ss:*

Eastern district of New York, in the second circuit.

Robert W. Russell and William S. R. Ogilby, being duly sworn, depose and say, and each for himself says that he is worth the sum of one thousand dollars, over and above his just debts and liabilities.

R. W. RUSSELL.
W. S. R. OGILBY.

Sworn to this 24th day of March, 1871, before me.

SAMUEL T. JONES,
U. S. Commissioner.

999 (Endorsed:) United States circuit court, eastern district, 2d circuit. The American Wood-Paper Company vs. The Fibre-Disintegrating Company. Bond for costs on appeal by defendants to Supreme Court United States. Filed this 24th day of March, 1871, Samuel T. Jones, clerk. Approved: C. L. B., U. S. judge.

The within is a true copy of a bond and approval of court thereon, filed in the clerk's office of the circuit court, for the eastern district of New York, in the within-named cause. Filed the 24th day of March, 1871.

[SEAL.] SAMUEL T. JONES, *Clerk.*

1000 Know all men by these presents that we, Earl P. Mason, of the city of Providence, in the county of Providence, and State of Rhode Island, as principal, and William S. Slater, of the same place, and Francis C. Nye, of the city of New York, in the county and State of New York, as sureties, are held and firmly bound unto The Fibre-Disintegrating Company, a corporation created and organized by and under the laws of the State of New York, in the full and just sum of five hundred dollars; to the payment of which, well and truly to be made to the said Fibre-Disintegrating Company, its successors or assigns, we, the said principal and sureties, bind ourselves, our heirs, executors, and administrators, jointly and severally, firmly by these presents, sealed with our seals, and dated this thirty-first day of March, A. D., 1871.

Whereas at a circuit court of the United States, for the eastern district of New York, in the second circuit, held at the city of
1001 Brooklyn, in said district, on the twenty-fourth day of March, 1871, in a suit in equity, depending in said court, between The American Wood-Paper Company, complainants, and the said Fibre-Disintegrating Company, defendants, the final decree of said court was rendered, whereby, amongst other things, the bill of complaint in

said suit was dismissed, as to the Watt and Burgess patents, re-issues No. 1448 and No. 1449, and the Keen patents, dated 13th of September, 1859, and 16th of June, 1863, respectively mentioned therein, and the said American Wood-Paper Company, complainants, thereupon, at the same term of said court at which said decree was rendered, and in open court, prayed an appeal from so much of said decree as dismissed said bill, to the Supreme Court of the United States, to be holden at the city of Washington, on the first Monday of December, A. D. 1871; and the said appeal was allowed by said circuit court:

Now, the condition of the above obligation is such, that if the said American Wood-Paper Company, complainants, shall prosecute
1002 their said appeal to effect, and answer all damages and costs if they fail to make their plea good, then this obligation to be void; otherwise to remain in full force and effect.

EARL P. MASON.
W'M S. SLATER.
FRANCIS C. NYE.

Sealed and delivered in presence of—
E. F. HARTE, as to signature of W'm S. Slater.
E. EMBREE, for E. P. Mason's signature.
E. F. HARTE, as to signature of Francis C. Nye.

(Endorsed:) United States circuit court, eastern district of New York. The American Wood-Paper Company vs. The Fibre-Disintegrating Company. Bond for costs on appeal. Approved: Cha's L. Benedict. March 31, 1871. Filed March 31, 1871. S. T. J.

1003. The within is a true copy of a bond and approval of court thereon, filed in the clerk's office of the circuit court for the eastern district of New York, in the within named cause. Filed March 31st, 1871.

[SEAL.] SAMUEL T. JONES, *Clerk.*

1004 Supreme Court of the United States.

THE AMERICAN WOOD-PAPER COMPANY }
vs.
THE FIBRE-DISINTEGRATING COMPANY. }

It is hereby agreed that the paper hereto annexed, marked Exhibit 35, is a true & correct translation of the paper marked "Exhibit No. 27 R. E. S., ex'r," in the copy of the record of said cause, sent to this court by the clerk of the circuit court of the United States, for the eastern district of New York, and that this translation may be printed by the clerk of this court in the record of said cause in this court, as if the same had been sent up with said exhibit in the copy of the record from the court below.

T. A. JENCKES,
For American Wood-Paper Company.
R. W. RUSSELL,
For The Fibre-Disintegrating Co.

1005 EXHIBIT 35.

Translation of "Exhibit No. 27. R. E. S., ex'r," in case The American Wood-Paper Company vs. The Fibre Disintegrating Company.

"4. The boiling of rags is mostly carried on in closed vessels under a pressure of from two to four atmospheres. In later time various kinds

of revolving kettles (revolving boilers) are used, partially in form of an upright cylinder, which, (just like the cylinders of an oscillating engine) turns upon trun'ions through which the steam enters; and partially in form of two cylinders, one fitting the other, of which the outer one remains fixed and the inner one revolves around its axis."

* * * * * * *

8. In England the manufacture of paper from straw differs from the methods that are followed in Germanny in these particulars:

With us the reduction of the materials is accomplished more by mechanical means, while in England the straw is boiled once or more in a strong lye, under a pressure of steam of from six to eight atmospheres, (in Germany it is boiled in open vessels,) and consequently, almost, as it were, dissolved.

In addition, crushing-rollers are also used, similar to those in our oil mills, so that almost no work at all remains for the grinding-mill. (Hollanders.)

L. B. Wright, of Gloucester, (in Chalford near Stroud,) has carried on the manufacture of the better sorts of paper from straw alone, 1006 to the greatest extent, using straw without any addition of rags.

By reason of the high price of rags and the cheapness of coal, the making of paper from straw has, in England, a more economical basis and an entirely different position from what it has with us. For the manufacture of the ordinary kinds of paper, the use of straw will certainly be upon the increase. On the other hand it would be useless to undertake to substitute this material for paper of the finer sort.

(Indorsed:) Supreme Court U. S., 1872, Dec. term, No. 259. American Wood-Paper Company, appellant, vs. The Fibre-Disintegrating Company. Agreement of counsel. Filed 20 January, 1873.

(Indorsement on cover:) No. 259, The American Wood-Paper Company, appellant, vs. The Fibre Disintegrating Company, filed 8th December, 1871, and No. 362, The Fibre-Disintegrating Company, appellant, vs. The American Wood-Paper Company, filed 9th March, 1872. E. New York C. C. U. S.

RECS. 259 & 362—33

O

IN THE

Supreme Court of the United States.

THE AMERICAN WOOD PAPER COMPANY,

Appellant,

vs.

THE FIBRE DISINTEGRATING COMPANY.

BRIEF

OF

THOMAS A. JENCKES,

For Complainants and Appellants.

ALSO IN CASE,

THE FIBRE DISINTEGRATING COMPANY,

Appellants,

vs.

THE AMERICAN WOOD PAPER COMPANY.

NEW YORK:
EVENING POST STEAM PRESSES, 41 NASSAU STREET, CORNER LIBERTY.
1873.

IN THE

Supreme Court

OF THE UNITED STATES.

THE AMERICAN WOOD PAPER COMPANY
Appellant,

vs.

THE FIBRE DISINTEGRATING COMPANY.

BRIEF

OF

THOMAS A. JENCKES,

For Complainants and Appellants.

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vs.

THE AMERICAN WOOD PAPER COMPANY.

NEW YORK:
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1873.

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In the Supreme Court

OF THE UNITED STATES.

OCTOBER TERM, 1873.

THE AMERICAN WOOD PAPER COMPANY *vs.* THE FIBRE DISINTEGRATING COMPANY:	No. 58.
and	In Equity.
THE FIBRE DISINTEGRATING COMPANY *vs.* THE AMERICAN WOOD PAPER COMPANY.	No. 151.

Brief and Points for the American Wood Paper Company.

CASE.

The American Wood Paper Company, of Rhode Island, are the owners of patented inventions for the manufacture of paper pulp and paper from wood, straw and other vegetable substances. These patents were infringed by the Fibre Disintegrating Company, a New York corporation, having a factory at South Brooklyn, in the Eastern District of New York. A suit in equity was brought to restrain these infringements, in which the bill set forth the title of the complainants to five several letters patent, and averred that the inventions therein described are capable of being used conjointly in the production of paper pulp, and that they had been so used by the defendants.

The following are the patents:

Two reissued patents, numbered respectively 1,148 and 1,449, upon a patent originally granted on the 18th day of July, 1854, and ante-dated the 19th day of August, 1853, to Charles Watt and Hugh Burgess, for an improvement in the manufacture of paper from wood, and which was subsequently surrendered by William F. Ladd and Morris L. Keen, being the owners of the same, and reissued to them on the 5th day of October, 1858, and again surrendered by said Ladd and Keen, and reissued to them, in the two reissued patents numbered as above, on the 7th day of April, 1863: one for an improved manufacture of paper and paper pulp from wood, and the other for the paper and paper pulp, the product of said process of manufacture.

A patent granted on the 26th day of May, 1867, ante-dated the 7th day of August, 1864, to Marie Amedeé Charles Mellier, for an improvement in the manufacture of paper.

A patent granted to Morris L. Keen, on the 13th day of September, 1850, for a new and useful improvement in boilers for making paper pulp from wood.

A patent granted on the 16th day of June, 1863, to Morris L. Keen, for an improvement in boilers for making paper pulp.

The answer sets forth the following grounds of defense:

1st. A general denial of infringement of each of the patents (*p.* 48).

2d. A denial of the validity of the Watt & Burgess patents, on the ground of want of novelty in the alleged inventions.

3d. A denial of the validity of the reissued patents, numbered 1,448 and 1,449, on the ground that they were not granted for the same invention as the original letters patent.

4th. A denial of the validity of the Mellier patent, on the ground of want of novelty in the alleged invention.

5th. A denial of the validity of the Keen patents, on the ground of want of novelty in the alleged inventions.

Evidence was taken upon all these issues, and the cause came on to be heard in the Circuit Court of the United States for the Eastern District of New York, before his Honor Charles L. Benedict, district judge of that district, holding the Circuit Court, and the decree signed by him (*pp.* 68, 69) expresses his findings upon such of these issues as he deemed material, in order to dispose of the case. The substance of the decree is as follows:

The Watt & Burgess patents are declared void for want of novelty.

The Mellier patent is found to be a good and valid patent, and the defendants are found to be infringers of it.

The defendants are found not to be infringers of the Keen patent.

Thereupon the complainants appealed from so much of said decree as relates to the Watt & Burgess and the Keen patents, and the defendants appealed from that part of the decree which sustained the complainant's bill as to the Mellier patent.

The complainant's appeal was made and allowed in open court at the term during which the decree was entered (*p.* 70), and their appeal bond was duly filed and approved (*pp.* 503–504).

Points for the Appellants—the American Wood-Paper Company—on the Watt & Burgess Patents.

I.

THE COURT BELOW ERRED IN ITS FINDINGS OF THE LAW AND THE FACTS UPON WHICH ITS DECISION IS BASED, AS TO THE VALIDITY OF THESE PATENTS ON THE GROUND OF WANT OF NOVELTY IN THE INVENTION.

1st. *As to the error in law.*

The specifications of the two reissued Watt & Burgess patents, describe processes for obtaining from wood or other vegetable substances a fibre suitable for the manufacture of paper. The claim of one patent (1,448) is for the fibre thus obtained as a new manufacture; the claim of the other (1,449), for the processes by which this fibre is eliminated from the wood. These processes as described are two, one

applicable to resinous woods, and one to non-resinous woods. The agencies by which this fibre is eliminated are purely chemical. They effect the entire removal of all the constituent elements of the wood, except a fibre which is suitable for paper-making; that is, the result or product is paper pulp, fit to be wrought at once into brown paper, and when bleached by old and well-known processes, into white paper.

The fibre which is to be obtained from the wood is composed of what is termed in chemistry *cellulose*. This and the other component parts of the structure of plants are well described in Regnault's Chemistry (*Sections* 1,274–5), which also contains the following definition of the term: "Chemists have given the name of cellulose to that constant substance which they regard as forming the cellular tissue of all plants." The agents by which all the other component parts of the plant are to be removed are heat and "caustic alkali."

"By a *solution of caustic alkali* is meant a solution of the soda-ash of commerce, by the removal of the carbonic acid by the action of quick-lime. The soda-ash is an impure carbonate of soda, and its carbonic acid unites with the lime and leaves the alkali in its caustic condition. The usual proportion in the solution is about a pound and a quarter of soda-ash to a gallon of water."

There are other re-agents used in the cleaning and bleaching of the cellulose after it has been delivered from the boiler or vessel in which it has been cooked, such as hydro-chloric acid, which is a compound of hydrogen and chlorine, and the chlorous or hypo-chlorous acid, which is a compound of chlorine and oxygen. The true agent in these portions of the processes is the chlorine, which is easily liberated from the substances with which it is combined when sold as an article of commerce.

The substances which are to be removed from the wood are called, as a whole, the intercellular matter. The action of the caustic alkali, intensified by heat, is

generally sufficient to destroy this intercellular matter, although sometimes the further action of chlorine is preferable, as described in the specifications.

The cellulose thus obtained from the wood is perfectly pure, and what is most remarkable, and in which the novelty of the invention consists, this substance is of the exact consistency, length and other dimensions required in a fibre for paper-making. Watt & Burgess were the first to discover this fact, and were the inventors of means to utilize this discovery and to produce by chemical agencies, a fibre which could be wrought at once into paper, a better and cheaper article for the purpose than had before been produced by mechanical agencies.

It was previously known that the fibres of cotton or of flax, used in paper-making were pure cellulose; and it was known to chemists that cellulose in some form and in some combination existed in wood, but it never had been eliminated from wood in a perfectly pure form, nor in a condition to be wrought into paper without mechanical treatment.

No witness, on behalf of the defendants, testified that any one of the processes to which reference was given in the answer of the defendants either had produced or would produce pure cellulose from wood, nor were any of the samples of paper produced by defendants' witnesses analyzed by their experts to ascertain the substances of which they were composed. It was not claimed that they were pure cellulose. It was proved by the complainants' witnesses, and not denied on the part of the defense, that the fibre described and claimed in reissued patent No. 1,448, and produced by the processes described and claimed in reissued patent No. 1,449, is pure cellulose.

While the cause was pending in the court below, cause involving similar issues upon the same pate was heard and decided in the Eastern District of Pe sylvania. The same error in law is to be found in t opinion of that court.

Judge Cadwallader says :

" The question is whether Watt & Burgess invented either the product or the process at or before the date of their English patent of 19th August, 1853, to which the American patents relate.

" Before this date, and before any maturity of their previous experiments, a pulp fit for making paper had been obtained by others from such fibrous substances as wood and straw, through the use of different processes for disintegration of the fibres. In every such case, the process had been one of successive stages. The substances had been boiled in an alkali, strong or weak, in open vessels and in closed ones, under pressure and without pressure. The process had never been such as to produce the pulp at one operation. In some cases the boiling itself had been repeated. In all of them, there had, besides mere soaking and cleansing, been a succession of mechanical or of chemical treatments, or of both, with applications of heat. But, as I have already said, a suitable pulp, that is to say, cellulose approximately pure, had, through some of these former processes, been obtained from both wood and straw. It is thus very clear that Watt & Burgess did not, nor did either of them, invent or discover the *product* as distinguished from the *process*."

Mr. Justice Grier gave no reasons for the conclusion to which he had arrived upon the Watt & Burgess patents. He might have concurred with Judge Cadwallader, or he might have sustained the patent taken by the defense as to the want of identity in the inventions described in the specifications of the original and reissued patents.

Judge Benedict, following the decision of the court in Pennsylvannia, says (6 *Blatchford*, (*pp.* 27, 28).

" In accordance with that authority, it must here be held that the Watt & Burgess patent, No. 1,448, which is for a pulp suitable for the manufacture of paper, made from wood or other vegetable substances, by boiling the wood or other substances in an alkali under pressure, as described, cannot be sustained as a valid patent for a new product. Aside from that authority, I should feel bound to say that it appears impossible to consider that to be a new material, patentable as a new product, which is simply a substance long well known to exist in wood and other substances, left in a state ' nearly pure,' and, consequently, fit for the manufacture of paper on being bleached by the removal from it of the intercellulose with which it is found to be combined in wood. The

patent No. 1,448 is for such a material as a new product, in the production of which, under the patent, if there be anything new, it is, as it seems to me, the process, not the product."

One of the errors in each of these opinions is, in assuming that the patent of the originator of a complete, perfect and successful invention can be defeated by any number of incomplete and imperfect experiments made at an earlier date. "The settled rule of law is," say this court, in *Agawam Co.* vs. *Jordan*, 7 *Wallace*, 583, 602, "that whoever first perfects a machine is entitled to the patent and is the real inventor, although others may have previously had the idea, and made some experiments toward putting it in practice. He is the inventor and is entitled to the patent, who first brought the machine to perfection and made it capable of useful operation." And in *Whitely* vs. *Swayne*, 7 *Wallace*, 685–7, this court also say: "He is the first inventor and entitled to the patent who, being an original discover, has perfected and adapted the invention to actual use." And if this rule be true with regard to a machine where all the parts and their functions are under the eye and hand of the operator, and where the place of the missing step to success is seen and known, and is often supplied by what, after it is accomplished, seems obvious and even trifling, how much the more strongly is it applicable to the cases of chemical inventions, where the operations are performed in close vessels, and are governed by those laws of affinities which are yet but imperfectly known? Neither of these judges finds, from reading the previous descriptions, that pure cellulose, fit for the manufacture of white paper, was ever produced from wood prior to 1853. Judge Cadwallader finds that "a *suitable pulp*, that is to say, cellulose *approximately pure*, had through some of these former processes, been obtained from both wood and straw." Judge Benedict says that this product "is simply a sub-

stance long well known to exist in wood and other substances, left in a state 'nearly pure,' and consequently fit for the manufacture of paper, on being bleached by the removal from it of the inter-cellulose with which it is found combined in wood." The thing produced by Watt & Burgess in its purity is not found, but only an "*approximately pure*" or "*nearly pure*" substance like it. That which had been a stain upon its purity, and thus had spoiled its usefulness in this art, has been clearly shown in the evidence for the complainants. By a series of carefully conducted experiments by competent chemists, we have unfolded the secret which had escaped all prior inventors, and explained the discovery of Watt & Burgess to a demonstration.

Another error was in assuming that there could have been in point of law no invention of a process requiring for its successful use at all times a graduation and adjustment of heat, strength and time, which could have been the subject of a patent, without the discovery and description of such graduation and adjustment. The fallacy of this position is apparent, when we consider how many of the most valuable inventions were made before the invention of any methods of measuring heat, or strength of the chemical agents. The thermometer, the hydrometer, and the pressure gauge, are all of recent date. Yet there are hundreds of inventions which require the use of heat and chemicals which were perfected before either was discovered. The manufacture of gunpowder is one of the most remarkable. Almost all chemical inventions are empirical in their origin, as the Supreme Court has recognized in *Tyler* vs. *Boston* (7 *Wallace*, 327): that is, a result is attained through chemical experiments which could not have been foretold by *a priori* reasoning. The conditions under which the new and valuable result is obtained must be carefully noted and compared. The discovery of the pulp in wood was as

complete when Burgess took it out of the mercury bottle in 1851, as it is at the present time. The substance was the same, in the same form and with the same properties as that which is now blown from his boilers every day. Compare what was done in this case with what was done by the inventor Charles Goodyear. He threw his piece of rubber mixed with sulphur and lead upon a stove, and being engaged in conversation, it remained there for some time. When he came to look at it, instead of finding it a liquid mass, as he expected, he found it hardened, while its elasticity and tenacity were much increased. What he took up is now known in the arts as vulcanized rubber. He then had obtained a result, and his invention dates from that hour. The invention of the hard rubber by Nelson Goodyear was also a similar empirical invention.

In both of the Goodyear patents, the original specifications of each patent were so defective that they were inoperative and invalid, and no protection was afforded the invention until a second and third reissue.

The cases on these patents will be referred to and examined. They settle the law for this case.

This original defectiveness in description must be more or less the case with every chemical invention. As it cannot be reasoned out in advance, so it cannot be best described until a successful, practical working of it, not merely a series of laboratory experiments illustrating it, has taken place, and close and continued observation had discovered its best conditions, proportions and results. In such inventions, experience comes first, philosophy afterwards.

The Law Applicable to Chemical Patents.

The cases upon patents for improvements in the arts by chemical inventions, reported in the books, are not numerous, but they all sustain the views now presented

to the court. One of the earliest of them is the case upon Hall's patent (*Webster's P. C., pp.* 97–103), for burning out the useless interstitial fibres of lace by gas. Fire and flame had previously been used for that purpose, and it was contended that a patent could not be sustained for the use of the flame of gas for the same purpose, nor for a current of air produced by a chimney draft, when the same current produced by a bellows had been in previous use. Yet the patent was sustained without serious question.

Derosne's patent (*Webster's P. C.*, 152–156; *Carpmael P. C., pp.* 664, 709) was for a filter of animal charcoal for purifying syrups of sugar. It was proved that charcoal, both animal and vegetable, had been used for the same purpose some years before this patent was granted, and that two patents had been taken out for such prior use Derosne placed the animal charcoal used in his process in the common charcoal filter which had been in use for the filtering of a great variety of substances. In this way he utilized the chemical properties of the charcoal for purifying purposes, with the best effect, and produced a syrup entirely pure, while by previous processes, in which charcoal had been used, it had become mixed with the syrup, and had not entirely removed the impurities, and could not be entirely removed itself. The patent was sustained and extended (2 *Webster's P. C., p.* 17). This case is instructive, as the invention was made by a chemist in his laboratory, and was not worked by himself but by licensees alone, nor was it brought into use for commercial purposes till after the issuing of the patent.

The cases of Neilson & Crane's patent are too familiar to need comment (*Webster's P. C., p.* 273 *et seq., p.* 375 *et seq., p.* 665 *et seq.*).

In Crane's case (*Webster's P. C.*, 409), the following passage from the judgment of the court is precisely applicable to the case at bar.

"We are of opinion that if the result produced by such a combination is either a new article, or a better article, or a cheaper article to the public, than that produced before by the old method, that such combination is an invention or manufacture intended by the statute, and may well become the subject of a patent. Such an assumed state of facts falls clearly within the principle exemplified by *Abbott, C. J.*, where he is determining what is or what is not the subject of a patent, namely, it may, perhaps, extend to a new *process to be carried on by known implements, or elements acting upon known substances, and ultimately producing some other known substance, but producing it in a cheaper or more expeditious manner, or a better and more useful kind.* And it falls also within the doctrine laid down by Lord Eldon, *that there may be a valid patent for a new combination of materials previously in use for the same purpose, or even for a new method of applying such material.* But the specification must clearly express, that it is in respect of such new combination or application. There are numerous instances of patents which have been granted, where the invention consisted in no more than in the use of things already known, but producing those effects so as to be more economically or beneficially enjoyed by the public. It will be sufficient to refer to a few instances, some of which patents have failed on other grounds, but none on the grounds that the invention itself was not the subject of a patent.

"We may put, for instance, Hall's patent, for applying the flame of gas to singe off the superfluous fibres of lace, where a flame of oil had been used before for that same purpose. Derosne's patent, in which the invention consisted in filtering the syrup of sugar through a filter, to act with animal charcoal, and charcoal from bituminous substances, where charcoal had been used before in the filtering of almost every other liquid except the syrup of sugar. Hill's patent, above referred to, for improvements in the smelting and working of iron; there the invention consisted only in the use and application of the slags or cinders thrown off by the operation of smelting, which had been previously considered useless for the production of good and serviceable metal, by the mixture of mine rubbish. Again, Daniel's patent was taken out for improvements in dressing woolen cloth, where the invention consisted in immersing a roll of cloth, manufactured in the usual manner, into hot water."

The Watt & Burgess patents are clearly within the rule above laid down.

Muntz's patent (2 *Webster P. C., p.* 85, *et seq.*) was sustained for the precise proportions of pure copper and pure zinc used in forming a "new manufacture for sheathing the bottoms of ships or other such vessels," where nearly the precise proportions had been used long before for the same purpose. The chemical

properties of the new combination were more useful than those of any previous mixture of the same metals, and gave it the character of a new invention.

One of the elements may be unimportant, and yet the patent be valid.

Electric Telegraph Co. v. *Brett & Little*, 20 *L. J. Rep. (N. S.) C. P.*, 123, 151, *Jur.*, 5, 9.

"The title of the patent and every part of the specification in which directions were given for putting the apparatus in use, mentioned 'metallic circuits' as means by which the electric current was conveyed, but no claim was made in respect to such circuits. At the time of the patent it was not known, but it was subsequently discovered that the earth might be used to complete the circuit, and that metal might be dispensed with to that extent, and the defendants had always used this discovery: *held*, nevertheless, that the defendants having been found by the jury to have adopted a part of the plaintiff's invention, the patent had been infringed."

This was Cooke & Wheatstone's patent for an electric telegraph.

In the case of *Newton* v. *The Grand Junction Railway Company*, 20 *L. J. Rep. (N. S.) Exch.*, 417, which was for a chemical invention in part, it was determined that the use of a substantial part of that in which the invention consists, constitutes an infringement of the patent.

In *Corning* v. *Burden*, 15 *Howard*, 252, we have the definition of a process, *p.* 267, and in *O'Rielly* v. *Morse*, 15 *Howard*, 62, the interpretation of the Neilson patent, *pp.* 115, 117. In *Gayler* vs. *Wilder*, 10 *Howard*, *p.* 477, which was a case upon a patent for an invention, chemical in part, the Supreme Court determined *(pp.* 496–7), that a single prior use of the chemical discovery which had not attracted public attention, but had passed away and been forgotten, would not invalidate a patent for the same discovery by an original in-

ventor, and that if such prior discovery is made and put in use abroad, it cannot be put in evidence to destroy a patent in this country, unless it has been made known to the world in some printed publication. (This rule excludes all the testimony of Wright as to what he actually did in England, which is not described in the publication cited.)

See also the cases upon Tilghman's patent for a process for manufacturing free fat acids and glycerine by the action of water at a high temperature and under pressure. Previous manufacturers had produced these materials from fatty or oily substances by the use of lime and other materials, but Tilghman was the first to discover that the chemical result could be produced by heat and water alone.

Tilghman vs. *Werk*, 2 *Fisher P. C.*, 227, *McLean and Leavitt, JJ.*

Tilghman vs. *Mitchell*, 2 *Fisher, P. C.*, 518, *Nelson, J.*

In the first case Judge Leavitt says:

"It is certainly true that some of the discoveries referred to approached very nearly to the discovery of the plaintiff, but as certainly stopped short of the object. They failed to reach the important chemical truth, that highly heated water, under pressure, will produce from fatty bodies free fat acid and solution of glycerine without any other agency."

In two recent English cases the law relating to chemical inventions has been stated with great clearness and precision. The earliest of these is *Hills* vs. *Evans*, 8 *Jur., N. S., p.* 525, on a patent "for improvements in the manufacture of gas." WESTBURY, Lord Chancellor, says, p. 529:

"What amounts to public knowledge or public use is still to be ascertained. One of the means of imparting knowledge to the public is the publication of a book, or the recording of the specification of a patent. If, therefore, in disproving that allegation, which is involved in every patent, that the invention was not previously known, appeal

be made to an antecedently published book or specification, the question is, what is the nature and extent of the information thus acquired which is necessary to disprove the knowledge of the subsequent patent? There is not, I think, any other general answer that can be given to this question than this, that the information as to the alleged invention given by the prior publication must, for the purpose of practical utility, be equal to that given by the subsequent patent. The invention must have been shown to have been before made known. Whatever, therefore, is essential to the invention must be read out of the prior publication. Apparent generality, or a proposition not true to its full extent, will not prejudice a subsequent statement, which is limited, accurate, and a specific rule of practical application. The reason is manifest, because much further information, and therefore much further discovery, are required before the real truth can be extricated and embodied in a form to serve the uses of mankind. It is the difference between the ore and the refined and pure metal which is extracted from it. Again: it is not, in my opinion, true in these cases to say that knowledge and the means of obtaining knowledge are the same. There is a great difference between them. *To carry me to the place that I wish to arrive at is very different from merely putting me on the road which leads to it.* There may be a latent truth in the words of a former writer, not known even to the writer himself, and it would be unreasonable to say that there is no merit in discovering and unfolding it to the world. *Upon principle, therefore, I conclude that the prior knowledge of an invention, to avoid a patent, must be knowledge equal to that required to be given by a patent, namely, such knowledge as will enable the public to perceive the very discovery, and to carry the invention into practical use;* and that appears to be consistent with the decided cases."

To the same effect is the decision of this court in the case of *Seymour* vs. *Osborne* (11 *Wallace R.*, 516; *see p.* 555).

"Patented inventions cannot be superseded by the mere introduction of a foreign publication of the kind, although of prior date, unless the description and drawings contain and exhibit a substantial representation of the patented improvement, in such full, clear and exact terms as to enable any person skilled in the art or science to which it appertains *to make, construct and practice the invention to the same practical extent* as they would be enabled to do if the information was derived from a prior patent. Mere vague and general representations will not support such a defense, as the knowledge supposed to be derived from the publication must be sufficient to enable those skilled in the art or science to understand the nature and operation of the invention, *and to carry it into practical use.* Whatever may be the particular circumstances under which the publication takes place, the amount published, to be of any effect to support such a defense, must be an amount of a complete and operative invention capable of being put into practical operation."

This language is as applicable to chemical as to mechanical inventions.

The case of *Young* vs. *Fernie*, 10 *L. T. Rep., N. S., p.* 861, is one of the first importance in relation to chemical inventions. The head-note is as follows:

"Where a patent has been taken out for improvements in the mode of producing a chemical substance, it is no bar to the legal validity of the patent that the subject of the patent is a product already known to scientific men, provided that the patentee is the first person who has produced the substance in sufficient quantities to make it a marketable article.

"The inventor of a substance, within the meaning of the patent laws, is the man who discovers the mode of producing it in such a form and to such an extent as to make it useful to the public at large.

"It is no bar to the validity of a patent for improvements in the mode of producing a particular substance, that similar processes have been employed to produce analogous substances, when the subject matter of the production is a chemical product, and the process is a chemical process.

"When the subject matter of an alleged invention is an improvement of a chemical process for the production of a substance, a patent, specifying a particular limit of temperature in the process may be valid."

The substance of the case was as follows:

"This was a patent for an invention for the obtaining of paraffin oil, or an oil containing paraffin, and paraffin from bituminous coals, by chemical treatment alone.

"From the evidence it appeared that paraffin was discovered by Reichenbach about the year 1832, but though many persons had made the attempt, no one before the plaintiff had succeeded in producing it in quantities sufficient to supply the market. It also appeared that many years before the discovery of parafin the process of distilling tar and coarse oils from bituminous substances had been discovered and practiced, and there were several patents which had been taken out in England for that purpose. Most of these patentees, however, had chiefly experimented upon bituminous schists and shales rather than upon coal. It was also known that a low temperature was necessary in order to produce paraffin in large quantities."

As to the novelty of this invention, it was argued that it was no objection to the novelty of a patent that words which might have an interpretation seemingly descriptive of a discovery were to be found in books already published, when such words were mixed up

with other matter in such a way as that no instruction was conveyed thereby to the public.

Hills vs. *The London Gas Light Co.*, 5 *H. & N.*, 312.
Hills vs. *Evans*, 8 *Jur.*, 526.
Steiner vs. *Heald*, 6 *Ex.*, 607.
Muntz vs. *Foster*, 2 *Webster P. C.*, 96.

STUART, V. C. After stating the points of the defense and summing up the evidence, says, p. 865 :

"In dealing with the case, it has seemed to me better to direct attention to what has been said by the witnesses for the defendants. One of them, Dr. Taylor, admitted that there are many chemical substances produced, not in abundance, but in small quantities, which, if they could be produced in large quantities, so as to be merchantable commodities, would be highly valuable. This is the proposition which seems to be at the root of the plaintiff's case. In the case of monopolies (9 Rep., 846), Lord Coke says, that all monopoly patents were void, both by the Common Law and the Statute, unless they were granted to the introducer of a new trade or engine. The words of the Statute of James I (21 Jac. 1, c. 3, s. 5), are: "the sole working or vending of any manner of new manufacture within this realm to the true and first inventor and inventors of such manufactures." Mr. Fernie, one of the defendants, has adduced in evidence a passage from the work of an eminent American chemist, Dr. Antisell, who holds an important position in the Patent Office of the United States of America. It appears that the plaintiff Young, has obtained a patent in the United States for his manufacture. This book contains a short history of the manufacture of paraffin oils and paraffin, and it gives the following extract from a publication by Reichenbach, in 1854: "So remained paraffin until this time, a beautiful item in the collection of chemical preparations, but it has never escaped from the rooms of the scientific man." Something, therefore, remained to be ascertained in order to the useful application of this article for economical and commercial purposes.

"This illustrates the important distinction between the discoveries of the merely scientific chemist and of the practical manufacturer, who invents the means of producing in abundance suitable for economical and commercial purposes that which previously existed as a beautiful item in the cabinets of men of science. What the law looks to is the inventor and discoverer, who finds out and introduces a manufacture which supplies the market for useful and economical purposes with an article which was previously little more than the ornament of a museum. It has been established to my satisfaction that the plaintiff Young is an inventor of this class, and that his patent is entitled to the protection of the law. I find that he has ascertained, by a course of laborious experiments, a par-

ticular class of materials among many, which has enabled him to create and introduce to the public a useful manufacture which amply supplies the market with that which, until the use of the materials and process and temperature indicated by him, had never been supplied for commercial purposes. At the date of his patent something remained to be ascertained which was necessary for the useful application of the chemical discovery of paraffin and paraffin oils.

"This brings it within the principle stated by the Lord Chancellor in the late case of *Hill* vs. *Evans*. The manufacturer, with the material and process indicated by him, according to the sense in which I understand the word 'manufacture' to be used in the statute, was a new manufacture, not in use at the date of his patent. The principle upon which the present case should be decided is, to my mind, so clear that it is unnecessary to examine the cases cited by the defendant's counsel. Inventions in mechanics are as widely different from inventions in economical chemistry as the laws and operations of mechanical forces differ from the laws of chemical affinities and the result of analysis and experiment in the comparatively infant science of chemistry, with its boundless field of undiscovered laws and undiscovered substances. This observation, as applied to reported cases will strike the mind of every lawyer who has even a slight elementary knowledge of both sciences."

The object or purpose is to be taken into view in the consideration of every chemical invention and the construction of the patent for such invention. (*Mowry* vs. *Whitney*, 14 *Wallace*, 620. *See opinion, p.* 643, 646.)

The finding of the court below is inconsistent in matter of law with these rules of law and of construction.

2*d*. *As to the error in fact:*

The court below erred in finding upon the evidence that a fibre composed of "cellulose approximately pure," or "nearly pure," or, "fit for making paper," had been obtained from wood or straw by any of the processes described in the defendants' exhibits. The language used by the courts below admits that *pure cellulose* had not been shown to have been the result of any of these processes, which were all experimental, and all of which resulted in signal failures.

The *characteristics* of the Watt & Burgess invention have been before stated (p. 6). *The essential*

elements for working the invention are, first, the wood or other vegetable material containing cellulose; *second*, the boiler, the peculiar construction of which is the subject of two of the complainants' patents; *third*, the caustic alkaline solution, of the simple constituents already defined, well known to all paper manufacturers, *fourth*, a high temperature or degree of heat. These working conjointly in another essential element, namely *time* of a sufficient period, will produce the required result. (*See specification, pp.* 12–13. *Rand, pp.* 208–9, *cross-int.* 5.)

One of these elements, *the boiler*, is, of course, constant and invariable. All the rest vary in greater or less degrees. The *wood* varies according to its species, whether hard or soft, dense or porous. Other vegetable substances from which paper may be produced by this process, are more porous or less dense than any species of woods. The *caustic alkaline solution* may vary with the quality of the material, the lighter and more spongy substances requiring a less quantity of alkali than the hard wood. The *degree of heat* must also vary from the first application of the fire till the whole mass is thoroughly digested, although it has been found that a temperature of 310° is required during a certain portion of the process. The *time* within which the operation can be performed must also vary with each of the other varying elements, the *minimum* only, as in the matter of temperature, being capable of being fixed with any degree of certainty. (*Burgess, p.* 123, *cross-int.* 106, *p.* 131, *cross-int.* 151).

The object is the removal of all of the intercellular tissue, leaving only the fibre which goes into the manufacture of paper. That result is obtained entirely by the action of these chemical agents. There are no mechanical means used for the purpose of aiding in the operation; all is done by the sole agency of chemicals. These are applied in such a manner as may be necessary to produce the desired result. Thus, while some of the elements remain constant, others

necessarily vary. If soft wood of a particular kind is used, like poplar, and the strength of the alkali is constant in all the experiments, then it may take four hours to remove all the intercellular tissue; if a harder wood, like oak, it may take eight hours to accomplish the same result. If the temperature is increased according to the hardness of the wood, it may take but a little longer time than is required to prepare the soft wood at a lower temperature. The elements change necessarily with the nature of the substance acted upon. (*Rand, p.* 221, *int.* 109.)

If, with the nature of the substance, the strength of the alkali is also changed, then correspondingly greater or less changes must take place in the temperature, and in the duration of the process.

The strength of the caustic alkali is determined by the hydrometer. There are two of these instruments, one known as that of Twaddell, or the English hydrometer, the other as that of Beaumé, or the French. They are differently graduated, one degree of Beaumé being equivalent to about $1\frac{1}{2}$ degrees of Twaddell; 17 degrees of Twaddell corresponding to 12 degrees of Beaumé. In general, the measurements in the record are given according to the graduation of Beaumé.

As it is not practicable, in the actual working of inventions requiring a high degree of heat, to connect a fragile thermometer with the apparatus, the temperature of the contents of the vessel to which the heat is applied is usually measured by a steam-gauge. The gauges in common use are constructed with a piston acted upon by the pressure of the steam generated in the boiler, with the steam acting freely upon an indicator in the open air. The piston thus operated does not indicate the whole pressure upon the internal surface of the boiler, but only the difference between that pressure and the weight of the atmosphere. The tables to be found in the books which profess to give for certain pounds pressure the corresponding degrees of temperature, and which are frequently called "the

French tables," start from a vacuum as zero. Gauges are always graduated so as to express the pressure in pounds above that of the atmosphere. Hence, whenever in the record the amount of pressure is stated as having been measured by the application of such steam gauges, it will be necessary to add to the amount stated the weight of the atmosphere, *i. e.*, $14\frac{7}{10}$ pounds to the square inch, in order to ascertain the actual internal pressure.

In order that there should be no mistake in this matter, the complainants have caused a series of experiments to be made by their experts, the results of which are to be found on page 225 of the record. (*See also Rand, p.* 81, *int.* 8 ; *p.* 103, *int.* 46 ; *p.* 104, *int.* 48 ; *p.* 204, *int.* 54.) The first three columns of figures give the results of experiments with distilled water. The three right-hand columns of figures give the results of experiments by Drs. Rand and Cresson with solutions of caustic alkali and intercellular tissues the strength of the solutions varying from 2 to 12 degrees Beaumé. It is to be observed, also, that as the density of the solution increases, the more heat it is capable of retaining ; in other words, the denser the solution, the higher the temperature at which it boils. Water boils at 212 degrees. Milk, being denser than water, requires a higher temperature. So, as the strength of this solution of caustic alkali is increased, a higher degree of heat is required before the point of ebullition in the open atmosphere is reached. Hence, the denser solution is capable of bearing and retaining a higher degree of heat under pressure.

Any description of the invention and of the mode of working it, must make allowances for the foregoing variable limits within which the desired action will take place.

It should also be borne in mind that *there is an entire difference between the chemical and the mechanical modes of manufacturing paper*. The processes by which paper pulp is produced from wood, straw and other vegetable

necessarily vary. If soft wood of a particular kind is used, like poplar, and the strength of the alkali is constant in all the experiments, then it may take four hours to remove all the intercellular tissue; if a harder wood, like oak, it may take eight hours to accomplish the same result. If the temperature is increased according to the hardness of the wood, it may take but a little longer time than is required to prepare the soft wood at a lower temperature. The elements change necessarily with the nature of the substance acted upon. (*Rand, p.* 221, *int.* 109.)

If, with the nature of the substance, the strength of the alkali is also changed, then correspondingly greater or less changes must take place in the temperature, and in the duration of the process.

The strength of the caustic alkali is determined by the hydrometer. There are two of these instruments, one known as that of Twaddell, or the English hydrometer, the other as that of Beaumé, or the French. They are differently graduated, one degree of Beaumé being equivalent to about $1\frac{1}{2}$ degrees of Twaddell; 17 degrees of Twaddell corresponding to 12 degrees of Beaumé. In general, the measurements in the record are given according to the graduation of Beaumé.

As it is not practicable, in the actual working of inventions requiring a high degree of heat, to connect a fragile thermometer with the apparatus, the temperature of the contents of the vessel to which the heat is applied is usually measured by a steam-gauge. The gauges in common use are constructed with a piston acted upon by the pressure of the steam generated in the boiler, with the steam acting freely upon an indicator in the open air. The piston thus operated does not indicate the whole pressure upon the internal surface of the boiler, but only the difference between that pressure and the weight of the atmosphere. The tables to be found in the books which profess to give for certain pounds pressure the corresponding degrees of temperature, and which are frequently called "the

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Any description of the invention and of the mode of working it, must make allowances for the foregoing variable limits within which the desired action will take place.

It should also be borne in mind that *there is an entire difference between the chemical and the mechanical modes of manufacturing paper.* The processes by which paper pulp is produced from wood, straw and other vegetable

substances, are totally different from the manufacture of pulp and paper from rags and cotton waste. The pulp produced from the latter is the result of mere mechanical action. Cellulose exists pure in the fibres of flax and cotton in their raw state. In the cotton plant it is the cotton itself, the down in the boll. In flax, it is the fibre which is separated from the wood of the stalk by rotting or other processes. In each, it is of much greater length than is found in wood, straw or other vegetable substances. It is of sufficient length to be spun and woven, but of too great length to be manufactured into paper. Hence, the rags and cotton waste have to be first cut or macerated. They are then subjected to a further process, called beating or grinding, by an engine, for the purpose of breaking up and shortening the fibre, and bringing it down from the length required for spinning and weaving, to the shortness required for being felted into paper. In wood and straw, the ultimate fibre of cellulose is often the exact length required for pulp, and it can be run into paper at once, when eliminated, without any preparatory mechanical treatment.

A description of the ordinary methods of manufacturing paper from rags may be found in *Muspratt's Chemistry as applied to the Arts, Title Paper, Vol. II, p.* 64, and in *Tomlinson's Dictionary, Title Paper.*

In the treatment of rags, they are in the first instance usually subjected to violent washings, for the purpose of removing the dirt or other foreign matter. Then, if of various colors, they are at some stage of the process bleached, so as to remove all the coloring matter. Then they are cut or torn into shreds and beaten by mechanical action, until at last the fibre is reduced to the proper fineness. In a paper mill, rags may be seen passing through the engines in all these different stages. The last result appears to be a mixture of skim-milk and water. This is the fibre in solution. That passes through the Foudrinier machine, and comes out in sheets of paper. The water is all filtered

off or absorbed, so that nothing remains but the fibre itself, which is felted in the machine, and finally assumes the consistency of paper, and is dried on a heated cylinder, so that at one end of the machine you will see this milk and water solution poured into it, and at the other, sheets of white paper rolled out from it.

In the manufacture of paper from rags there is little or no necessity for any chemical process, except bleaching, which is used in all manufactories of white paper. In some factories a weak solution of soda-ash is used, and the rags are boiled in an open boiler, or a boiler with a loosely fitting cover, for the purpose of removing the foreign substances. In the manufacture of paper from ropes or bagging, or coarse hemp or flax from which the woody fibre has been imperfectly removed, the boiling has the effect to soften the foreign substances, which are then broken by the action of the grinding engine, and afterwards entirely removed by the pulp dressing machines. In paper from which these foreign substances are only partially removed there are specks, which are evidently not fibre. These are known as "*shives*"; they are the hard substance which is not reduced to pulp. Some specimens filed in this case are made with a mixture of straw, some of which has not been completely reduced by chemical action. But it is necessary, in the production of white paper, that everything of that kind should be taken away. That is done in the complainants' invention solely by chemical action. In the manufacture of paper from rags it is done by grinding and beating, and by washing and dressing the pulp. The paper is then manufactured by what are generally known as the Fourdrinier machines.

The inventions described in the patents owned by the complainants cover no part of the process beyond the washing of the pulp or the placing it in the vats for the purpose of being washed. When the pulp is once produced, it can be manufactured into paper in

the same manner as by any of the well known modes. The field of our inventions, therefore, is from the log or the plant to the pulp. Bleaching is common to all processes. As soon as the pulp is produced it may be dressed and cleaned from "shives" or any foreign substance that remains, and immediately worked into paper.

At first, and indeed, for several hundred years, the processes in use for the manufacture of paper were purely mechanical. From the thirteenth century, when the manufacture of paper from rags and the fibre of cotton and flax was first introduced into western Europe, the art received little improvement, even in modes of manufacture, until the latter part of the eighteenth century. All chemical processes are of recent introduction. Chemistry, as a science, is scarcely a century old, and, as applied to the arts, its history is within the recollection of many living men. The first attempts were to substitute chemical for mechanical agencies in the treatment of materials well known as suitable for the manufacture of paper, and were, to a limited extent, successful. Then chemists began to attack new substances, and to combine chemical and mechanical processes. They worked blindly, for their science had not then developed facts enough from which they could reason with certainty.

The history of these inventions is not unlike that of most other great discoveries. There are the usual number of wrecks of unsuccessful efforts; the same fallacies have led unlearned experimenters astray; the same delusions have ruined those who have taken imperfect experiments for successful discoveries. But in the light of the beautiful science in which they were vainly working, we can now clearly distinguish their errors and point out the reasons why they failed of success. We can also demonstrate with certainty the methods by which our inventors attained and secured their perfect result.

The result of these discoveries is one which could not

have been predicated upon any facts before known. It was known, indeed, what material was wanted for paper-making, and that the material wanted existed in some form, and in a variety of combinations, in wood and straw, but it was not known in what form or in what condition it might be eliminated. If cellulose should be produced in fibres of such length, and possessing such properties as those in which it had previously been found and used in the manufacture of paper, the experiments would have provided only a new variety of "paper stock" for the manufacturer, which would have to be subjected to the ordinary mechanical treatment before paper could be made from it. But this result is such that it is not merely pure chemical cellulose which is produced, but cellulose in such form and with such properties and in such condition that it can be at once felted into paper. It is not like the cellulose of cotton or linen, dry, hard, elastic, long and angular in its structure, requiring these properties to be removed before it becomes fit to make paper of, but cellulose, soft, spongy, flexible, and of the precise length of fibre to be felted at once upon the proper machinery. *(Rand., p.* 92, *ints.* 12–15, *and Exhibits.)* It was known that wood or straw could be easily saturated and softened by alkaline solutions, and that heat would increase their effect. But it was not known that the combined action of heat and alkali would remove all the intercellular tissues, and leave the fibre a pure cellulose, with the precise form and qualities desired. No process of *a priori* reasoning would disclose that all which is harmful in the vegetable substance would be removed, and all that was useful and valuable for paper-making would remain. In other words, the result of our invention is not merely pure cellulose as a chemical fact, but *a new manufacture*, fit for paper, composed of pure cellulose.

This invention thus supplies one of the greatest wants in the production of paper, by introducing into its manufacture the cheapest and most abundant of

raw materials, all vegetable substances containing fibre. It also lessens the manual labor by dispensing with the preliminary mechanical process; and although heat is one of its agents, the shortening of the time of operation diminishes the expense of fuel. The other agents are lime, one of the most abundant of raw materials; and the soda-ash of commerce, one of the cheapest and commonest of chemicals. These two substances are held in solution by water, so that the chemical agents used in this process are the least expensive, and require less skill in manipulation, of any which are known in chemistry as applied to the arts.

The proportion of pulp of pure cellulose derived from the wood is about thirty per cent. of the weight of the raw material. The intercellular tissues form about seventy per cent. in weight of the raw material, and these are consumed and carried off in the spent alkali. The testimony on both sides agrees in this. (*See Burgess, p.* 87, *int.* 53*; Rand, p.* 98, *int.* 36*; p.* 211, *cross-int.* 22*; McCracken. p.* 7, *int.* 44; *Townsend, p.* 149, *cross-ints.* 19–21.)

If now we take *a view of the history and state of the art of paper manufacture* prior to 1853, the date of the original Watt & Burgess patent, we shall gain a better understanding of the place which their invention took in that art, and also of the specifications and claims of the patents, and a more just idea of the nature and extent of the infringements. The patents and public works which are referred to in the answer of the defendants and in the evidence, bring before the court the whole history of the chemistry of paper-making as it stood prior to the date of the inventions described in the patents set forth in the bill of the complainants.

One thing will be observed of all the methods of manufacture described by the several supposed previous inventors: they are all based upon the old and well known mechanical processes, and bring in chemical agencies as ancillary only. By far the larger proportion, also, deal with straw, bark of trees, and

the fibrous plants from which paper has been produced for centuries, and the chemical agents are applied for softening or loosening the fibres, and not for dissolving or entirely removing the intercellular tissue. Only two or three have ventured to attack wood. It will be observed, also, that they were all entirely barren of any useful result.

Some of them refer to improvements in the method of bleaching. It must be remembered that until a very recent period all bleaching was by the open air process. The rags of which white paper was made were grass bleached before they were cut or ground in the machines. Bleaching by the methods now so common was unknown before the discovery of chlorine in 1774, and its practical use had not increased to any great extent till within the present century.

Hector Campbell, in letters patent granted to him in England in 1792, speaks of the optional use of an alkaline ley in bleaching materials for making paper, but his principal agent is muriatic, now called hydrochloric acid. His process was applicable only to rags and other paper material then known (*pp.* 333, 336; *Rand, p.* 94, *int.* 19).

William Cunningham's patent of 1794 (*pp.* 336, 339) refers only to the treatment of rags of various kinds and qualities (*Rand, p.* 94, *int.* 20).

The patent of John Turnbull, Jr. (*pp.* 340, 344), relates only to methods of cleansing and bleaching by means of chemicals (*Rand, p.* 94, *int.* 21).

Matthias Koops appears to have been the first person who conceived the idea that a pulp could be produced from straw, hay, thistles, and some kinds of bark and wood by chemical treatment, which could be manufactured into a rough kind of paper. A specimen of his work remains to this day in the Congressional Library. His specification (*pp.* 344, 347) as well as

his sample, show how crude and imperfect were his ideas as well as his product (*Rand. p.* 95, *int.* 22).

That of J. V. Degrand (*p.* 348), granted in England in 1838, describes an attempt to obtain a fibre from wood for paper stock by the use of a bath of lime. He does not refer to the use of heat or pressure or of caustic alkali (*Rand. p.* 95, *int.* 23).

That of George Robert D'Harcourt (*p.* 350), also granted in England in 1838, proposes the use of fibres of certain vegetables, which he names, for paper stock, but does not mention wood. Neither does he mention pressure by means of heat, nor the use of alkali (*Rand. p.* 95, *int.* 24).

That of Morton Balmanno (*p.* 352) describes an attempt to utilize the bark of trees, and some herbaceous plants like the hop-bine, &c., for the production of paper stock. He proposed to boil these substances in a weak solution of alkali, but not under pressure. His means are otherwise purely mechanical (*Rand. pp.* 95, 96, *int.* 25).

Edward Cooper (*p.* 355) proposed to utilize the "cane brake" or "megasse" of sugar cane for the production of pulp, but he does not describe the use of any chemical process (*Rand. p.* 96, *int.* 26).

John Small (*p.* 358) merely makes a suggestion for the use of the fibres of certain plants in paper-making, and also in spinning and weaving. He does not describe or claim any process (*Rand. p.* 96, *int.* 27).

Miles Berry (*p.* 359) proposes the use of the "Esparto" grass in paper-making, to be first steeped in lime-water, and then treated like rags or other paper stock. He also suggested the use of the fibre of this grass in spinning, weaving, rope-making, &c. He did not propose to use alkali or heat (*Rand. p.* 96, *int.* 28).

Lewis Wooster and Joseph E. Holmes (*pp.* 382–3), in a patent taken out in the United States in 1836, suggested the use of wood shavings for the manufacture of paper, and a preliminary treatment with alkali or lime, at a boiling heat. The idea of using pressure did not occur to them (*Rand. p.* 4 , *int.* 34).

William Magaw, in a patent taken out in this country in 1828 (p. 385), suggests a mode of treating straw, hay or other vegetable substances, by boiling in ley from ashes, or steeping in such a ley, so as to prepare the material to be ground in the usual way to be manufactured like rags into paper. He did not use boiling under pressure (*Rand, pp.* 98, *int.* 33).

The extent of the knowledge of the use of chemicals in paper manufacture exhibited in the specification of the foregoing patents, seems to have been confined to the fact, that the mechanical processes in use before for the reduction of the well-known substances used in paper-making to a paper pulp might be hastened or shortened by the application of hot caustic alkaline solutions at certain stages of the manufacture. The earliest patent which exhibits any considerable improvement in the knowledge of the use of chemicals was granted to Montgolfier Frères, in France, in 1838 (*defendants' answer, p.* 55, *Record, pp.* 444, 459), and was for machinery and processes for treating the raw material in a series of five operations.

The first of these was a preparatory maceration, or rasping down, or grinding of the wood or other material, and from the figures of the machinery given in their specification, it is evident that this preliminary trituration must have been very thorough. The use of straw, hemp, &c., is disclaimed.

The next operation was "to aid the removal of the 'gluten' by a concentrated alkaline bath for a considerable time under high pressure." No length of time or strength of alkali or degree of heat is mentioned as requisite for the purpose of removing the "gluten."

The substance was next submitted to the action of two series of rollers, to bring it to "the first fibrous state." It was then treated with alkali a second time in this fibrous state. It was then submitted to the bleaching operation, and is described as a "homogeneous pulp, *resembling* that of cotton."

In a "second patent of additions and improvements," they describe their operations more particularly. The wood is first to be reduced to chips, and then, "in the state of chips," it has to be "immersed for five or six days in quick-lime." It is then treated with the beating machine, by which it is "reduced to a fibrous state by crushing the chips softened by their maceration in lime water." The substance is next "placed in a close vessel with a solution of caustic potash, and boiled under pressure for twelve hours." (No strength of alkali or degree of heat is mentioned.) It is next washed in hot water and submitted to the process of bleaching.

Their theory of paper-making was, *first*, to destroy the primitive form of the wood by "loosening the resinous connections which bind the fibres;" and, *second*, to re-unite the fibres by returning to them their original cement and cohesion—that is, as they express it, by "refixing the resin which was rendered soluble by a previous operation." Thus they say: "It is necessary to incorporate in the pulp some resin, * * * otherwise it is necessary to mix some hemp with the wood pulp." They speak of the fibres which they obtain as "ligneous fibres," and state that the usual bleaching process will not succeed with the pulp produced in the manner which they describe, but that their process of bleaching, which is not described, but which is stated to be the subject of "a secret patent," must be used before a homogeneous white pulp can be obtained. They also state that the total loss in the conversion of wood to pulp is about thirty per cent.; or, in other words, that they obtain seventy per cent. of fibre fit for the manufacture of paper.

From these results, as stated by them, it clearly appears that they had not obtained from the wood the pure fibre or cellulose, which does not exceed from thirty to forty per cent. of its weight, and that such fibre as they did obtain was little more than the ground or mechanically disintegrated wood which could not be manufactured into paper without the introduction of pure fibre from hemp, cotton, or some other fibrous material. The fibre obtained from wood will not felt in the machine if any portion of the ligneous matter called "lignine" remains attached to it, nor will it bleach, unless that substance is entirely removed. It would seem that the Montgolfiers never succeeded in overcoming these difficulties, as there is no evidence, either from books or the testimony in the case, to show that their invention ever went into use, or even that any paper was ever made in accordance with it.

(*Rand., p.* 99, *int.* 36, p. 211, *cross-int.* 22; *Burgess, p.* 87, *int.* 33.)

The defendants produce even a less percentage of pure pulp.

(*McCracken, p.* 75, *int.* 44; *Townsend, p.* 149, *cross-int.* 19-21.)

In the same year, 1838, a patent was granted to M. Wise, for a boiler for "an improved apparatus for treating with lye and bleaching, rags and other material used in making paper." This patent was on the first day of January, 1841, declared forfeited. It describes a rotary boiler, and a mode of heating the material to be pulped, which is immersed in lye by means of the introduction of steam through the trunnions or hollow axis of the vessel. It is simply a means for making use of the chemical agents then known.

(*Rand, pp.* 99-100, *int.* 37.)

In the following year a patent was granted to Mons. Moinier Legoux. (*Deft's answer, p.* 58; *Record, p.* 481.) He describes the object of his patent as "the application of mechanical and chemical processes" for the purpose of converting into pulp certain substances which he mentions, among which is wood. His first operation is to disintegrate the wood by rasping, grinding, stamping, or other mechanical means, some of which he describes, and he states that although probably mechanical means might be sufficient to reduce the substance to "half stuff," yet it would not be fit to be converted into paper without the aid of his chemical process. The principal of these is "softening the cut substances," freeing them of their "gluten and resin," by boiling them under pressure of three or four atmospheres, equal to about 276° F. to 294° F., in a boiler of water in which has been introduced a small quantity of boric acid, the water having been mixed with common soap as caustic as possible. This operation may be preceded by a "maceration of the substances in caustic lye," the component parts of which are given, but there is no direction to use heat or pressure in connection with this alkaline solution. The processes of Legoux remove none of the lignine or other substances contained in the wood which are injurious in the manufacture of paper. In one part of his process he adds lime to his material, which is positively hurtful, as it fixes the color. It is evident that no real pulp was produced, and that the product could not be bleached.

(*Rand, p.* 100, *int.* 38.)

In 1840 a patent was issued in this country to John Campbell, assignee of George Spofford for an improved boiler for treating refractory materials used in the manufacture of paper, such as straw, cotton waste, ropes, etc., in which an "alkaline or other liquid" was used as the digesting fluid, and heat was applied either directly or by the introduction of steam. He does

not mention any particular degree of strength, or any requisite component parts of the digesting liquid, nor does he indicate any particular degree of heat which was to be applied to or introduced within his apparatus. "His only object was to produce, by the rotary movement of the vessel containing the *charge* and the digesting liquid, the complete intermingling of the two, and the perfectly equable action of the digesting liquid upon every portion of the material heated." (*Judge Hall, Record, p.* 29; *Specification, pp.* 385, 388.)

In 1843, Lemuel Wellman Wright obtained a patent in England "for machinery or apparatus for bleaching fibrous substances, and manufacturing the same into paper." (*Rand, p.* 362.) His specification describes a complicated apparatus for boiling and bleaching straw and similar substances, preliminary to their being manufactured into some kinds of paper. He simply repeats the process already in use in a costly and cumbrous apparatus, which according to the expert testimony could not, and according to his own did not, produce paper in any quantity, either of a satisfactory quality or at a profit. The time required in his operations, the extent of the apparatus, and his ignorance of scientific chemical action, will be seen by a mere enumeration of what is required to be done. (*See Patent of* 1843, *p.* 362.) He first boils his material in lime, then grinds it, then washes it, then boils it again in lime, washes it again, then digests it in a dilute solution of sulphuric or other acid, again washes it, again reboils it in alkaline solution, again washes it, then bleaches it at a temperature of 212 degrees, then "sours," and washes it again. He gives the strength of his solution at about two degrees of the English hydrometer, and when mixed with lime the solution would be, if the component parts of the liquid are stated correctly, of a strength varying from 0.86 degrees to 1.72 degrees. He does not mention any temperature at which the boiling should be effected in his close vessels, nor any test by which it could be ascertained when the pulping was completed.

By using these processes he may sometimes accidentallv have produced a fair pulp from straw, but such could not have been his regular or usual product. He did not discover the law which governs the removal of the intercellular tissues by chemical action, although he was continually groping in the neighborhood of it. The manner in which his mode of manufacture, as well as that of others in England, is spoken of in the translation from the *Central Blatte* (*Record, pp.* 465, 505), shows that it was confined to coarser papers, and was considered as useless for the finer sorts. His samples, according to his own testimony, were looked at merely as curiosities, and the results of his own business, as stated in his testimony, would certainly afford no encouragement to others to attempt to use his supposed invention.

Wright's experiments are the only ones from which we have any relics, and concerning which we have any living testimony. His English patent was taken out in 1843. His occupation prior to that time was a bleacher. (*Record, p.* 165.) It seems that he made three attempts to manufacture paper from straw in England, and that each attempt was a failure. First, in North Wales, for about six months, by way of experiment, in 1843; then at St. Mary's Mill, Chalford, in 1844–5, where he made common coarse straw paper; then at Spring Mill, Chalford, in 1847, for about six months, where he attempted to make white paper. He actually made nothing there but pulp, which was sent to be made into paper at other mills. (*Record, p.* 235, *int.* 91.) There was but sixteen hundred weight of pulp made in all at this mill (*p.* 235, *int.* 91), not more than the usual product of two boilings. He then abandoned the business (*same int.*), and it was never resumed under his patent, either by himself or by any other persons in England or in this country.

His whole apparatus was crude and cumbrous, and his processes unscientific. Thus he used four boilers,

several tubs or kiers, a variable pressure, several mechanical operations, and trusted a great part to grinding and mechanical arrangements. He boiled, at an uncertain temperature, in milk of lime for twelve hours, which fixed the color, and rendered the product incapable of being bleached. No good result could be obtained from his processes under two days. His apparatus was weak, and if high pressure should be used, dangerous, as the head of one of his boilers, as described, would have to withstand a pressure of 125,000 pounds at a pressure of one atmosphere, and the bottom of another a pressure equal to 104,000 pounds. In the light of subsequent discoveries, the reasons for the failure of his experiments, both mechanically and chemically, are clearly apparent. (*Rand, p.* 97, *int.* 29; *Wright, p.* 236, *int.* 104; *Rand, pp.* 205–6, *ints.* 56, 57).

The attempt to connect Mellier, one of our patentees, with actual personal knowledge of Wright's experiments proves a fourth failure of an attempt to work this supposed invention in France. (*Record, p.* 167, *int.* 16.) This statement obtains some confirmation in the communication from Mellier's attorney to the Commissioner of Patents on the original application for the patent. (*Record, pp.* 263–4.)

No portion of the deposition of Wright is evidence in this case for any purpose. We can look only at the specification of his patent of 1843, which is the only publication of his alleged invention of which we have had any notice. What he did in his various mills in England subsequently is not described in any public works printed prior to 1853–4, nor had his process or product been actually introduced into this country as a manufacture at any time. (*Record, p.* 235; *Wright, int.* 87.)

Wright's American patent of 1847 (*p.* 416) contains substantially the same specification as the English patent of 1843. No work was ever done under it in this country. (*Wright, p.* 237, *int.* 107; *p.* 167, *int.* 17.)

Moses Poole took out a patent in England in 1845 for the use of the broom plant in the manufacture of paper pulp. (*P.* 368.) He treats the plant mechanically, and then boils in lime water, with or without soda. He does not use pressure boiling, nor caustic alkali. (*Rand., p.* 97; *int.* 30.)

So, also, the invention of Clothon Breuil, patented in 1846, for the employment of vegetable bark in the manufacture of paper, resulted in a product described as "tow," like that derived from hemp or flax, and which is to be treated in the same manner in the manufacture of paper. He also injures his material by using lime in contact with it. (*Rand., p.* 100; *int.* 30; *Specification, pp.* 477–78.)

The invention of *Mons. Gros* for the employment of the broom plant in the manufacture of paper, for which a patent was granted in 1847, consisted in treating the stalk or wood of the broom by a series of mechanical and chemical processes, which resulted in a substance which "looks like a textile material torn in shreds." It is then to be treated a second time with lye, then washed, "and afterwards torn up finer than rags are;" so that his patent relates to the production of a material out of which paper pulp can be made by the well-known mechanical processes, and not the production of pulp by direct chemical action. (*Record, pp.* 438–443; *Rand., pp.* 101–2, *int.* 40; *p.* 103, *p.* 208; *ints.* 63–64; *pp.* 218, 219; *cross-ints.* 92–99.)

There seems to have been no new improvement in the manufacture of paper by chemical agencies made or described between the years 1847 and 1852. The extracts from German works (*Record, pp.* 423–35) refer to the processes already considered. The books to which we usually refer to ascertain the state of the industrial arts of this period treat these experiments as both scientific and commercial failures (*pp.* 105, 106.)

Rand (*pp.* 102–3; *int.* 43) has classified all the patents of which notice was given in the answer of the defendants. He shows that in no one of them was it described or claimed that a pulp of pure cellulose had been produced by chemical means alone, or by mechanical and chemical means combined. Pure cellulose was unknown to those experimenters as a product from the raw material they experimented upon. In fact, all of those references were dropped by the counsel for the defendants in the examination of their experts, except the patent of *M. Gros*, and that is exhibited to the Renwicks with a question calling for an answer as to its bearing on reissued patent No. 1,449, the patent of Watt & Burgess for their process. (See *H. B. Renwick, p.* 311; *int.* 4; *E. S. Renwick, pp.* 318–19; *int.* 14.) No witness is asked the question as to the identity of the references with the product patent. *Prof. Rogers* (*pp.* 328–9; *ints.* 9, 10) is asked only about the preparation of the solution of soda-ash by Gros.

This case has therefore this remarkable feature, that there is no testimony on the part of the defendants to substantiate the defense of want of novelty in the product patent, reissue No. 1,448. Indeed in the case in the Third Circuit, Judge Cadwallader stated, in his opinion, that the learned counsel who argued the case on the part of the defendants "assumed that the case must be decided upon the patent, No. 1,419, alone." This kind of fallacious reasoning appears in the answer of Henry B. Renwick, above referred to.

But *the process patent, No.* 1,449, is equally untouched as the product patent in their issue of novelty. The comparison made with the process of Gros is incomplete and deceptive. There is no language in the specification of Gros which shows that he believed that he had eliminated a pulp of pure cellulose from the broom plant *by chemical agencies alone, at one operation.* He evidently considered his mechanical treatment of the raw material of as much importance as his chemical

operation. In his boiling he does not reach the minimum degree of heat prescribed by Watt & Burgess, and the time during which the boiling is to continue is vague and uncertain. The substance produced from the first boiling in alkali "must be immediately, and without having been washed, placed on the pressing plate and crushed with the roller until it has the looks of a textile, oakum-like matter" (*p.* 43). This is not pulp fit to be manufactured into paper. "After this it must be submitted to a second (lye) bath, similar to the first; then well washed on the cylinders, and afterwards completely ground—and much finer than rags," &c., giving directions for further treatment, both chemical and mechanical. The simplicity and directness of the Watt & Burgess process is wholly wanting.

But this defense was considered in the case in the Third Circuit upon all their references, and Judge Cadwallader thus disposes of it on the evidence.

Judge Cadwallader says, concerning reissue No. 1,449:

> "The specification will therefore be considered as including a legally sufficient claim of the invention of the process of boiling in an alkaline solution in a close vessel with such a graduation and adjustment of heat, strength and time as will produce the pulp at a single operation. That the process thus claimed, if actually invented by Watt & Burgess at any time not later than the date of their English patent, was new, is, I think, on the evidence unquestionable. Therefore, if they had invented it by the 19th of August, 1853, the reissued patent must be maintained."

Hence the defendants fell back upon two other defenses which were fully argued in the court below, and will probably be reproduced here. These were: 1st. That the patent was improperly reissued in two parts; and, 2d. That the reissued patents are not for the same invention as the original patent. That

THE REISSUE WAS PROPERLY TAKEN IN TWO PARTS,

is settled by the decision of this court in the case of *The Providence Rubber Company* vs. *Goodyear's Exrs.*,

et al., 9 *Wallace*, 797, affirming a number of decisions made in the Circuit Courts on the Goodyear patents.

The case cited also disposes of the defense rather hinted at than taken in the answers of the defendants, that the reissue of 1858, and the reissues No. 1,448 and No. 1,449, of 1863, were improvidently issued by the commissioner of patents, and were improperly obtained by the patentees.

THE REISSUED PATENTS ARE FOR THE SAME INVENTION AS THE ORIGINAL PATENT.

We have from Burgess *the history of the invention* and of their original patents in England and in this country. He says (*p.* 84, *int.* 21) that he commenced to make experiments on the preparation of pulp for paper-making purposes in 1851, in conjunction with Mr. Watt, and he describes these experiments as follows (*int.* 22):

"My first experiments were carried out on a small scale. At this time I had no laboratory of my own, and was limited as to apparatus, and was compelled to work with such apparatus as I could find in my friends' laboratories. Such apparatus as I could not procure in one place I would seek in another. Vessels used for boiling wood in alkalies under and without pressure, were of the ordinary experimental kind used in a laboratory, such as small iron boilers, glass flasks and iron enamelled ware I generated the chlorine and hypochlorous acid in the usual apparatus, making large glass vessels answer the purpose of gasing and bleaching chambers. I worked until I ascertained the nature of the intercellular tissue of wood, what means would effect its destruction and leave the fibre intact, and also what was the proportion of this fibre."

Thus far he relates nothing but laboratory experiments. Substantially all that is in Regnault and Dumas. The French chemists had been working to find out what wood is made of. That was the whole object of their search. It was an investigation for mere curiosity, and their discoveries take their place among the thousands of results which the laboratory discloses, but which are not applied to practical use till long after-

ward, and seldom by the discoverers themselves. The professional chemist analyzes the substances placed before him, and ascertains their component elements, and when this is done, and the record is made, his work in the laboratory is ended. As for practical results, the scientific chemist, as a general thing, has very little idea of it. It is not for such experimenters that the patent laws are made, but for practical men, who take up the facts which scientific men scatter forth from the laboratory, and put them to practical use, so that the world may obtain some benefit from them. Around such inventions of practical use the patent law throws its protection, and to them it gives its rewards. A great many instances can be recalled where substances have been discovered in the laboratory, but the practical use of them was not discovered till long afterward. One of the most remarkable is that of chlorine. It was discovered accidentally. So in regard to the discovery of oxygen by Priestley. He hardly knew what it was when he got it. He knew it was a component part of a certain substances, but there were thousands of other substances of which it was a component part, and which he did not and could not know of. The use of both these elemental substance was not known in the arts till a long time after their discovery.

Watt & Burgess were practical as well as scientific chemists, and conducted their experiments with a practical object in view. Burgess goes on to say :

"The decomposition of the intercellular tissue was effected by several methods; chromic and permanganic acids, and one or two compound processes were used and pulp was produced."

They first used acids, and found that two of them would remove the intercellular tissues and leave a pulp. Here are three distinct processes for producing pulp from wood discovered in the laboratory. One of them was briefly described in the English patent. Each might have been the subject of a patent. He also

gives a reason why they were not patented ; they were too costly. It is not every laboratory experiment, however beautiful and promising, that can become a commercial success. Chemistry, as applied to the arts, takes up and follows out only those experiments that are profitable. In their case the experimenters found out that by the use of acids a fibre suitable for pulp could be extracted from wood, but at too great cost, and they turned their attention to cheaper reagents. Burgess continues :

"The effect of caustic alkaline solutions was examined into as well as chlorine in a liquid and gaseous form. I made a great many experiments in boiling wood in caustic alkaline solutions. My knowledge of chemical reactions taught me the great advantage afforded by increase of temperature in effecting chemical decompositions, and the idea of boiling under pressure occurred to me."

That was from his scientific knowledge, not by accident or empirically.

"I produced a good pulp by boiling wood in caustic alkali at a high temperature. I found that some woods required much more alkali than others. I found that when intercellular matter was not wholly removed by caustic alkali, it could be decomposed by chlorine or the hypochlorites, one answering the purpose as well as the other. I used, therefore, chlorine or bleach powder, preferably chlorine, since one of the products attending the elimination of chlorine, namely, sulphate of soda, had a marketable value in England."

"I found that to a certain extent, and when desirable, I could substitute the employment of caustic alkali for chlorine, the one for the other, but the nature of the wood under treatment materially affected this substitution." "As regards the cost, the chlorine process appeared to cost less than the free use of alkali, since one of the products of its elimination is a marketable article in England, and we calculated on the sale of the sulphate of soda as one of the sources of profit in working the patent. In drawing up the specification for a patent, I therefore laid most stress upon the process that seemed to offer the greatest pecuniary advantage, since the recovery of the soda-ash had not been practically tried by us at this time, and we were in uncertainty as to the success of such recovery."

Here he describes the discovery of two processes for eliminating the pulp, one by means of caustic alkali

alone, at a high temperature, and one by the use of caustic alkali and the use of heat, with or without pressure, supplemented by the action of chlorine.

Judge Cadwallader sums up the testimony of Burgess in relation to his experiments as follows:

"He testifies that in a laboratory, in 1852, he produced a pure pulp by boiling in a caustic alkaline solution. But how long it was boiled he does not state, nor of what strength was the liquid. He says that he had not the means at his disposal for determining the pressure used. How many, or what were the stages of the process, he does not mention. He left England for the United States in the early part of 1854. The single previous experiment in which he had made a pulp at one operation, occupied only about twenty minutes, when he was alone in the laboratory. On this occasion he put about a pound of pine wood into a wroght-iron mercury bottle, of the size of about 14 by 6 or 8 inches. He could not recollect the strength of the solution, and had no means of determining the pressure."

Whatever may be said about the impossibility of his having known the details of the process, yet it is evident that the discovery of the product was complete when he took the pulp out of the mercury bottle. The process also was complete, but it could not, from such an experiment, be described with precision. It is the same as that now in practical use, so far as its elements are concerned.

This was probably one of the rashest experiments ever made. The short time in which the result was produced shows the use of an extremely high temperature. Nothing but a mercury bottle could have withstood it. His invention and himself might have come to a sudden termination. Davy and Faraday have experimented almost as rashly as did Burgess, but very rarely. He had this idea of the mode of producing pulp in his mind, and he was determined to discover whether it was true, and he did. At this high degree of temperature the time of operation was very short; but Rand and Cresson have produced good pulp in an hour, and even in less, in their small experiment boiler (*table*, *p.* 223). The testimony of Burgess stands not

only uncontradicted and unshaken, but confirmed by the experiments of the experts.

In 1852 Burgess prepared a draft specification of a patent for their invention, the original of which is produced as an exhibit (*p.* 167, *A. H. S.*, *No.* 6; *see photographic copies.*) In this draft he described the use of high or low pressures, in the following words:

'The wood upon which it is intended to operate by this process should first be reduced to very fine shavings, the finer the better; this may be done by any suitable machine. The shavings should then be boiled in caustic alkali of the strength indicated by about 12° of the English hydrometer. This process is much better performed under pressure. After the wood has been boiled for about 24 hours (but we do not confine ourselves to this time, as it varies with the nature of the wood and amount of pressure)," &c.

After having satisfied themselves that pulp could be produced from wood by means of heat and alkali alone, and by heat and alkali, with the aid of chlorine, they apply for and obtain their English patent. This specification was written by Burgess himself (*p.* 85, *int.* 23) without the aid of a solicitor. It sets forth in inartificial phrase the process by the use of sulphurous acid, the process of boiling in alkali and subsequent treatment by chlorine, and asserts the value of boiling in alkali under pressure; and it speaks of "*the pulp obtained*" by the use of these processes.

The specification of the American Patent of July 18, 1854, was also prepared by Burgess himself (*p.* 86, *int.* 26), and is in the same language as the English specification, omitting the description of the sulphurous acid process, and adding the claim. Being the work of a layman unskilled in the drawing of such documents, however skillful in his own peculiar art, that specification has many defects or omissions, which are hereafter referred to.

We have this positive testimony of Burgess, one of the inventors, to the origin and history of this invention, and the fact that such pulp was produced as an original invention prior to the taking out of the English

patent in August, 1853. (*Record, pp.* 84, 85.) This testimony is not varied, contradicted or impaired by any countervailing testimony, or by cross-examination. This result, he swears, was accomplished in 1852, although they continued to experiment on their processes till they took out the patent. Specimens of the pulp and paper made from it were filed at the Patent Office, upon which the patent was granted. (*See correspondence with Patent Office put in proof by defendants, pp.* 391-8.) These were the first samples of pure cellulose obtained from wood, without incrust or foreign substance, fit to be at once bleached and made into paper, ever seen in the world. It made its appearance, not in long and hard fibre like the cellulose of cotton, flax and hemp, nor in a starchy form, as the cellulose of potatoes and grains, but in a soft, porous, flexible fibre of about 1-10 of an inch in length, having all the properties of the mechanically manufactured fibre for paper. It is as perfect as if it had been grown in the log for that special purpose.

The correspondence with the Patent Office and the action of the commissioner at the time of granting the original patent, are of special importance. The passage in Regnault's Chemistry is relied upon by the examiner (Mr. Gale, who writes in the name of the commissioner) to defeat the application. (*See correspondence, p.* 393.) From this rejection by the examiner, an appeal was taken to the commissioner, Judge Mason. These samples seem to have been shown to him, and it would appear that he investigated the subject personally. He closed the controversy by the following emphatic opinion:

Application of Watt & Burgess. Improvement in Making Paper.

DECISION OF COMMISSIONER.

The applicant proposes to make paper from woody fibre by treating it in a certain manner. Chemists have before shown, that by treating woody fibre in a manner not widely dissimilar to that pointed out by the appellant, a substance which is termed *cellulose* is obtained, It was also known that *cellulose* constitutes, in an almost pure state, the substance

of which paper has heretofore been made. Under these circumstances, it has been thought that the making of paper in the manner pointed out by the applicant was not patentable. But it is one thing to ascertain a scientific fact, and it is another and very different thing to subjugate that fact to the common every-day purposes of life. The latter is patentable, the former not. Can it be possible that a pine plank can be formed into a ream of paper without including a patentable discovery in the process by which that end is attained?

Now, the chemist who merely separates the collulose from the other ingredients of the wood cannot stop there and obtain a patent for his discovery.

In order to claim such a patent he must show some practical benefit that will result from it. The benefits of the Patent Law are entirely intended for the practical man.

The man of science makes the great discoveries which the practical man turns to account. The labor of the former may be far the most meritorious; the latter is the only one for whom a pecuniary recompense is provided.

In the case of making paper from wood, if the present applicant cannot obtain the patent, no one can.

This of itself would seem sufficient reason for granting the patent.

But by changing our point of view, we shall see the reason of this more clearly. Science had ascertained that *cellulose* could be obtained from wood, in substance, the same as the fibre from flax or cotton. If, now, some one should contrive a means of transforming this *cellulose* into a substance that could be spun and woven into strong and durable cloth, does anyone doubt of the patentability of the discovery? The making of paper would seem almost equally so. Again, the discoveries of the chemist are irrespective of expense. Whether the means used can ever be employed practically in constructing any material from cellulose for common use, is wholly unknown, so far as anything has been ascertained from him.

The pointing out a practical mode of producing cellulose from wood in a manner requiring so little labor and expense as to cause its adoption in the useful arts, involves a patentable discovery.

A patent will therefore be granted.

C. Mason.

And because the cellulose thus produced differs in length, form, structure and qualities from any ever before seen, requiring no mechanical treatment before it becomes useful in the arts, but possesses all the conditions of immediate usefulness, we claim that the inventors were entitled to a patent for the product. Indeed, the cellulose described by the chemists as the result of the laboratory experiments upon wood can

hardly be called a product, and it was not suggested that it could be put to any use whatever. Regnault says (§ 1,275), "that if the operation be carefully conducted, and re-agents diluted into water alone be used, the greater portion of the cellulose *escapes destruction.*" And in the trituration recommended by Dumas (*Chimie, Vol. 5, p.* 117), the length of the fibre would be entirely destroyed, and it would be ground into the fineness of flour and become what he describes as a "pasty substance." Watt & Burgess obtained the entire cellulose of the wood in a form practically perfect and immediately useful, and they were the first to do so.

The simplicity of the invention is the greatest difficulty in the way of sustaining it. James Watt, to whom we are indebted for the steam-engine, said that he labored in the courts for seven years before he could convince anybody that he had invented anything. Yet the steam-engine dates from him.

So now it is objected that Watt & Burgess are not entitled to a patent for their pulp as a new manufacture, because the substance of which it is composed was known before. Cellulose, it is said, existed in the fibre of flax and of cotton, and was known by chemists to exist in wood. Though Watt & Burgess may have discovered a process, which may be termed a new and useful art, for extracting or eliminating the fibre from wood. yet what they produced, it is asserted, is not other or different from the fibres of flax or of cotton, all of which in their component parts are chemically identical.

But this is an entire mistake. The fibres of flax and of cotton are not identical in structure or qualities with those of wood. The fibre of flax averages about an inch in length, is prismatic in form, separated by knots like straw, except that they are introverted; it is strong and hard, and after certain mechanical treatment is suitable for spinning and weaving. The fibre of cotton averages nearly the same length as that of flax, but is

flat, and twists on becoming dried; is soft, elastic and spongy, and when cleaned of its seed is at once fitted for spinning and weaving. Neither of these fibres is fitted for being felted into paper until they are cut up into short lengths and made soft and flexible by the cutting and beating engines. The fibres for paper should not be more than one-tenth of an inch in length, and should be beaten till they lose their elasticity.

See Dr. Ure, Philosophy of Manufactures, Chap. 1 Fibres.

The cellulose derived from wood, by the Watt & Burgess process, is of the exact length and possesses the precise qualities which fit it to be converted into paper at once. It is soft, non-elastic, porous, and mats or felts properly in the paper-making machine without any previous mechanical treatment. In the form of pulp rolled into sheets, in the condition in which it leaves the log, it is an article of commerce. It is not extracted or eliminated from the other vegetable material with which it is combined in growth, as the fibres of flax and cotton are, and Watt & Burgess were the first to extract it in a suitable condition for any useful purpose whatever. If this is not a new manufacture, it is difficult to describe one.

The article of commerce known as wood pulp, fit to be at once manufactured into paper, was never seen or known before.

Pulp made by mechanical means from rags, flax, cotton and hemp, was well known, but it was not composed of the fibres of those substances in their natural condition. The fibre from the wood, composing the wood pulp, came forth as it grew, and was perfect in its fitness for its new use.

If it could be spun and woven into cloth or textile fabrics, would any one have questioned its being a new manufacture? Thread spun, or cloth woven, from the fibres of wood, has certainly never been seen. How is the case altered when these fibres are felted into the

pulp of commerce, or into paper, which is only pulp in a manufactured form? Is not wood paper a new article? And if useful, is it not patentable? And who can deny its usefulness?

If charcoal should now be produced for the first time, no one can doubt that it would be patentable as a new manufacture. All the ingredinets of the wood, except the pure carbon, are expelled from it by the action of heat, in the same manner as all the ingredients, except the pure cellulose, are expelled by the action of alkali at a high temperature. Yet it might be objected to a patent for charcoal as a new manufacture, that it was nothing but carbon in nearly a pure state, and that carbon was well known in such state, and was a product of nature in the diamond, and in an anthracite, and plumbago. Yet the properties of these substances are so different (although chemically the only difference is in the molecular arrangement) that such an objection would be absurd. So the same chemical formula that represents cellulose, also represents two other substances, dextrine and starch. (Regnault, §§ 1,275, 1,281) Neither of these substances are fit for the manufacture of paper like the cellulose from wood; nor of cloth, like the cellulose from flax and cotton. In fact cellulose is nothing more than a name for a chemical formula, C^{12} H^{10} O^{10}, and neither the name nor the formula have any reference to its use.

So that if the fibre of flax had never been produced before, but should now be eliminated for the first time from the woody fibre with which it is combined in growth, there can be no question that the discoverer would be entitled to a patent for a new manufacture. If it had never been seen before, and should be produced in a condition fit for spinning and weaving at once, no other term could more properly be applied to it. Each one of the numerous processes by which it can be produced might be patented, and the discoverer of the original process would be entitled to

patents for such of its principles as he may have invented

As the fibre of flax is constituted for being spun into thread and woven into cloth, so is the fibre of wood and of straw precisely fitted for being felted into paper. In the case supposed, each would be equally new in the arts. Can it be possible that the Patent Laws can give such discoverers no protection?

Practical uses in the arts and not new chemical formulas, should determine whether substances produced by chemical action deserve to be called new manufactures. If, like this wood pulp, such new substances meet and fill a great want in the practical business of life, there can be no question of their merit. A book, like this brief, made wholly from wood, was never seen till Watt & Burgess taught how it could be made. It is therefore new. Lately it was a log, now it is a book. Is it not a new manufacture?

INTRODUCTION OF THE INVENTION INTO USE.

These inventors were continuous and persistent in their attempts to bring their invention into use. Some paper was made experimentally in England, after the date of the English patent, but this country, on account of the great abundance and cheapness of the raw material, was selected as the best field for developing the new manufacture.

Burgess accepted an offer to work the invention in this country soon after the date of the English patent, (*p.* 86, *int.* 27); he left England in the winter of 1853–4, with the specifications of his patent prepared and signed; he arrived in New York early in February, and before the 6th of February, his application was in the Patent Office. (*See correspondence, p.* 391.) After considerable correspondence, it was finally rejected by the examiner (Dr. Gale), on the 15th May, 1854. Then followed the hearing before the commissioner; the commissioner's emphatic decision, already given, and the issuing of the patent, July 18th, 1854 (*pp.* 251, 396).

As soon as there was a probability that the patent would be granted, Burgess procured the necessary apparatus for working his invention experimentally, among which was a boiler capable of sustaining considerable pressure for boiling the wood in caustic alkali (*pp.* 86-87, *ints.* 28-30). This was in June, 1854 (*p.* 87, *int.* 29). The apparatus was put in operation in August (*int.* 30), and pulp was produced by a single operation by heat and alkali during the summer of 1854 (*p.* 87, *int.* 31). Burgess' memory of dates is here supported by his original note-book, which is made an exhibit in the cause. Photographic copies of some of the entries, showing the use of heat and pressure, are also made exhibits. The entries upon this book contained minutes of exceptional experiments which Burgess thought worth recording, not of the daily business. The apparatus was set up at Gray's Ferry, on the Schuylkill, near Philadelphia, and pulp was made and sold regularly to the manufacturers of paper during the entire period of their operations at that place. (*Burgess, pp.* 87-88, *ints.* 31-34.)

"Q. 19. State whether you succeeded in the manufacture of paper pulp from wood, and what was done with the pulp so made?

"A. The manufacture of pulp from wood, by the process as recorded in my journal, was a success. Some of the pulp made at Gray's Ferry was sent to Mr. Warren's paper mill at Maylandville, some to Messrs. Magargie Brothers, and some to Mr. Howard Lewis."

This pulp was all made in the boiler, under pressure. He worked with the safety-valve set so as to blow off at 120 pounds (*Keen, p.* 242, *int.* 3). Its capacity was from 100 to 200 pounds to the square inch (*p.* 242, *int.* 3). This experimental business at Gray's Ferry was continued for five months from August, 1854 (*Burgess,* p. 87, *int.* 32). As soon as the success of the invention had been demonstrated at Gray's Ferry, larger works were put up at Royer's Ford, on the Schuylkill, which have been in operation from 1855 to the present time, with the exception of a short stoppage in 1857. The pulping has been effected both by the single and

double operation according to the kind of wood operated upon. Larger works have since been put up at Manayunk, so that the quantity of wood pulp manufactured according to the Watt & Burgess invention in this country at the time of the filing of this bill, was about fifteen tons a day (*Burgess, p.* 88, *ints.* 35-36; *Keen, p.* 242, *int.* 6), and at the time the testimony was taken, upwards of twenty tons.

When the works were put in operation at Royer's Ford, experiments were made to test the minimum pressure at which the various kinds of wood might be pulped. Then for the first time, about April or May, 1856, the pressure gauges were applied to the boilers. Before that time the maximum pressure only was ascertained by means of the safety valve (*Keen, p.* 242, *int.*, 3). There has been no change in the working of the invention from the time it was put into practical operation at Gray's Ferry until the present time (*Burgess, pp.* 88, 102, *ints.*, 35–36; *Keen, p.* 242, *int.* 6, *p.* 249, *cross-ints.*). The mechanical apparatus used is substantially the same, the chemical agents are the same, and used in the same proportions: the time of operation and the degree of heat are the same, and the result is the same.

Before taking out their patent in England, Watt and Burgess had worked only with the implements of their laboratory, and their experience in producing paper pulp was derived mainly from their laboratory experiments. Within a year from that time Burgess was making paper pulp for the purchaser of the American patent, at an experimental establishment at Gray's Ferry. This could not be called a paper mill, as no paper was manufactured there, but the pulp was sold to the paper-makers. It was submitting the laboratory experiment on a large scale to the test of commercial success. The invention cannot be said to have been fairly tested and worked until the starting of the Royer's Ford Mill, early in 1856. But Burgess was persistent

in his endeavors to introduce it into use, and it was pushed as rapidly as possible.

It is to be considered, furthermore, that this is an invention which could not go *per saltum*, from its origin to the full growth. Burgess could not go to a paper-mill, and say: "I have discovered a means of producing pulp from the most abundant raw material right at your doors, at much less expense than from rags; won't you introduce it?" He might prove the truth of his offer, but they would have had to answer that they could not do it. They would naturally have all the ordinary doubts that arise as to new inventions; but, even if they had none, with the best will in the world, they could not have welcomed his invention. They had no apparatus for trying it. The invention was calculated to make an entire revolution in the paper business, and to supersede all the old modes of manufacture.

In the paper-mills constructed in 1853, there were no close boilers capable of bearing 60 pounds pressure, much less for one hundred and twenty to one hundred and forty pounds, which is sometimes used. The boilers then used for the purpose of making rags were generally open, or with loose fitting covers, such as are described in the Coupier and Mellier patent, or in the Spofford patent, which is for the purpose of reducing refractory material, such as ropes or colored rags, or stock full of knots, and is capable of sustaining a pressure of only from twenty to forty pounds. That was all the purpose of the boilers then in use. No degree of heat or amount of pressure is maintained in the Spofford patent (*see Specifications pp.* 386–388). Everything was left to the judgment of the operator. The only boiler Burgess could find suitable for his purpose was an old locomotive boiler capable of standing two hundred pounds pressure. Almost all the mills in this country then used, and still use, the old mechanical mode of trituration, pounding by fulling-mills, boiling, beating, cutting and grinding, in the open engines by mechanical means throughout, until the final bleaching

is perfected. Not a paper mill in the world could have tested this Watts & Burgess invention. The machinery had to be created, all the experiments had to be made on a large scale, before that which had been done in a laboratory could be acknowledged as a new and valuable result in the arts. It had to be demonstrated, in in the first place, whether the production of wood pulp was a success, and, in the next place, whether it could be produced profitably; for men who advance money to develop a new invention must see the probability of getting their money back. They do not expend money for laboratory experiments. After the tests had shown this invention to be a success, the factories to work it had to be built from the foundation. It is only from its own inherent vitality and truth that a scientific idea of this nature can develop itself into a great manufacture, and it is a slow growth from this acorn to the oak.

This testimony concerning the introduction of the invention into use, shows that there had been in the mind of Burgess and of his associates no doubt about the success of their new manufacture. The difficulties in the way of introducing a new invention are not evidence of doubts concerning its success. All inventions meet with more or less difficulty. The stafe of the times, the value of the product, the appreciation of labor, the importation of cheaper articles from abroad, and many other contingencies, may supervene to prevent the immediate working of the invention. But this had to grow from a small beginning. From the seed planted at Gray's Ferry came all these great mills now making paper from wood and straw, constructed and operated upon an entirely different principle from any prior paper-mill, working in an entirely different way, and producing an entirely different product. Instead of being evidence of an intent of abandonment, it is the best evidence to the contrary. Instead of being doubtful of success, there was a persistent determination on the part of the inventor to succeed, which was finally triumphant.

Thus we have, in this case, the whole continuous history of a great invention, from its earliest commencement to its large development. It met with extraordinary difficulties in being introduced, not only from the nature of the invention and the mode of using it, but from the fact that its introduction would displace other manufactories then successful and profitable. If paper can be produced from wood cheaper than from rags, the latter business will diminish, and the capital invested in it will become of less value. The whole business is interfered with by this novel invention. Hence it met with opposition from all the trade, and favor from none. It had to be introduced by parties not engaged originally in the paper manufacture, but who were willing to undertake the working of a new invention which would be a probably successful rival of the old methods.

Having shown what the invention is, and its origin, history and success, it will now be shown that it is more accurately described in the amended specification of the reissued patent, and that

THE REISSUED AND ORIGINAL PATENTS ARE FOR THE SAME INVENTION.

This reissued specification will be examined and criticised in the light of the *law relating to reissued patents.*

I find the most thorough summary of the decisions prior to 1863, when these reissued patents were taken out, in the opinion given by Judge Hall, concurred in, as the report states, by Mr. Justice Nelson, in the case of *Hussey* vs. *Bradley*, 5 *Blatchford*, 134.

"But it is well settled," says that learned judge, in p. 141, "that in deciding upon these applications for a reissue, and upon the question whether the invention claimed in the reissue is the same invention which was intended to be patented on the original application, the commissioner of patents is not confined to the claims, nor even to the examination of the evidence furnished by the specification, models and

drawings accompanying the original application; and that any legal proof to show it to be the same invention should be received. (*Ex parte Ball, ex parte Dayson and Wilson* v. *Singer, Law's Patent Digest, pp.* 620, 621.) It is also well settled that the decision of the commissioner of patents upon the question, is *prima facie* evidence of such fact, and that the subsequent inquiry, when the question is presented to a court and jury, is limited to the fairness of the transaction—to the question of fraud in the surrender. (*The Philadelphia & Trenton R. R. Co.* v. *Stimpson*, 14 *Peters*, 448, 458, 459; *Stimpson* v. *Westchester R. R. Co.*, 4 *Howard*, 380, 404; *O'Reilly* v. *Morse*, 15 *Howard*, 62; *Battin* v. *Taggert*, 17 *Howard*, 74. 84; *Woodworth* v. *Stone*, 3 *Story*, 749, 753, 754; *Day* v. *Goodyear, Law's Digest, p.* 617, *sec.* 6.) Even a statement in an original patent, that a part is old, or a disclaimer of a part, does not, it seems, necessarily prevent such part from being claimed in a reissued patent, though it would have that effect if made advisedly, and not by inadvertence, accident or mistake." (*Ex parte Hayden and Laidley* v. *James, Law's Digest.*)

And further on, pp. 148, 159:

"We cannot say, as matter of law, that these reissues were too late, nor is there any proof of fraud or laches upon which we can, on that ground, declare these reissued patents void. A reissue has been upheld when the surrender was made more than sixteen years after the first patent was issued (*Gibson* v. *Harris*, 1 *Blatchf. C. C. R.*, 167), and it was there said that a patent which had been extended to twenty-one years, under the general law, and afterwards extended to twenty-eight years by special act of Congress, might be surrendered and reissued after the term of twenty-one years had expired. (See, also, *Woodworth* v. *Edwards*, 3 *Woodb. and M.*, 120; *French* v. *Rogers, and Goodyear* v. *Day, Law's Digest, pp.* 614, 615, *secs.* 27 to 32.) The fact that a portion of these inventions was not claimed in the original patent does not, as we have already shown, defeat the present claims of the patentee; and even a disclaimer, in the original patent, of an invention claimed in a reissued one, is not, without other proof, enough to avoid the reissued patent. (*Ex parte Hayden and Laidley* v. *James, supra.*) It is true that in the case of *Battin* v. *Taggart* (2 *Wallace, Jr.*, 101), *Judge Kane* decided that if a patentee neglects, in his specifications, to assert his invention as to a certain part, omits to claim specifically such part, and suffers his patent so to stand for a number of years, he cannot afterwards surrender his patent and take a reissue claiming such part, as the use under the former patent, without any claim, will be a dedication to the public. But this decision was overruled by the Supreme Court of the United States in the same case (17 *Howard*, 74), and the cases bearing upon this question, to which we have already referred, are, we think, sufficient to show that we cannot, after the action of the commissioner of patents, in respect to these patents and without other

proofs, hold that there has been any abandonment or dedication to the public of the inventions claimed in these reissued patents. Independently of the question of abandonment or dedication, it is well settled that the prior use of an invention, under a defective patent, cannot take away the right to surrender such patent and take out a new and amended one, or authorize a use under an amended patent. (*Stimpson* v. *The Westchester R. R. Co.*, 4 *Howard*, 380, 402; *Goodyear* v. *Day*, *Law's Digest, pp* 614, 615, *secs.* 30, 31, 32; *S. C., Id., p.* 624, *sec.* 27; *Id., p.* 625, *sec.* 33: *Battin* v. *Taggart*, 17 *Howard*, 74-84.) In law a reissued patent is generally considered, except in respect to infringements prior to its issue, as if granted at the date of the original patent (*Carr* v. *Rice, Law's Digest, p.* 625, *sec.* 33); and the corrected patent in respect to all subsequent infringements, is made to take effect as though it had been so issued originally, even though the original patent was invalid. (*Bloomer* v. *Stolley*, 5 *McLean*, 158; *Shaw* v. *Cooper*, 7 *Peters*, 292, 315; *Stanley* v. *Whipple*, 2 *McLean*, 35, 37; *Smith* v. *Pearce*, 2 *McLean*, 176; *Carr* v. *Rice, Law's Digest, p.* 625, *sec.* 33.) We cannot, under the authorities above cited, sanction the position, that these reissues come too late, or that the patentee had forfeited his rights by the delay in procuring reissues covering such portions of his invention as were not included in the claims annexed to his original patent of 1847."

In *Poppenhusen* v. *Falke*, 2 *Fisher, P. C.*, 181, Judge Shipman speaks of language of disclaimer in the original specifications as follows, p. 187:

"The question now is, whether the field which they have thus entered is included within Meyer's invention? Not merely whether it is within the description of his invention contained in the first patent, or within the description of what was intended to be *disclaimed* in the first patent. But is it a part of his *invention?*"

"Without dwelling upon or deciding this question, it may be suggested that inadvertence and error may occur as well in the *disclaimer* as in the *claim*, and that whenever the mistake occurs, it may be cured by a reissue. The effect of an erroneous disclaimer upon the right of a patentee to recover damages which accrued before the error was corrected by a reissue, might be a grave question."

In the same case, on final hearing, it was complained that the reissue had been taken on account of the construction which had been given to the patent by Judge Ingersoll. Judge Shipman says, and the opinion is concurred in by Mr. Justice Nelson (2 *Fisher, pp.* 220, 221).

"It was suggested on the argument that it would appear by a com-

parison of the original and reissued patents in the light of Judge Ingersoll's opinions, that the object of the reissue was to extend the monopoly secured by the patent beyond the limit assigned to it by those opinions. This may be, and doubtless is, true. It is quite likely, too, that the necessity, or at least the desirableness of a reissue, was first suggested by the remarks of Judge Ingersoll in defining the original patent. But the inference that we are asked to draw from this fact that the reissue was therefore fraudulent and void, is wholly inadmissible. It not unfrequently happens that a judicial interpretation of the specification or claim of a patent, or both, discloses to the inventor or patentee for the first time the defects in the instrument, and shows him that he has unwittingly restricted his rights within narrower limits than his discovery, or so inartificially described his invention that he has failed to secure any substantial advantage by it. Such a disclaimer furnishes a proper occasion for a surrender and reissue, when the error was inadvertent, and is clearly within the beneficent design of the statute. The judicial mind gives a legal construction to the language of the instrument, and this construction may reveal the fact that the terms were found to cover the invention. To hold that the inventor should not be allowed to restate his claims by the use of new terms, would defeat the object of the law, and abridge or strangle the inventor's rights with the imperfect language in which he has attempted to clothe his discovery."

The recent decision of the Supreme Court in the case of *The Providence Rubber Company* vs. *Goodyear's Ex., et al.*, is conclusive upon all these questions, and affirms the validity of reissues of a patent for chemical processes, with greater variations than are to be found in those upon which this suit is brought.

This decision also shows that the comparison should be made between the latest reissue and a previous reissue and not with the original specification.

SWAYNE, J.—"The patents reissued to the executor upon the surrender of the patent reissued to the testator, were numbered respectively 1,084 and 1,085. The one numbered 1,085 is for the process by which vulcanized India rubber is manufactured. The other one is for the result of the process in the form of the article produced.

It is contended by the appellants that both these patents are invalid for two reasons: 1st, because they are broader than the claims of the patent surrendered by the executor; and, 2d, because one is for a process and the other is for a product of that process. The court below held the objection to the patent for the process—that it is too broad—fatal to its validity, because the claim embraced "other vulcanizable gums" besides India rubber, as articles to which the process was to be applied.

From this part of the decree below no appeal was taken by the complainants. It is, therefore, final and conclusive in its effect, and the patent to which it relates must be laid out of view. It remains, therefore, to consider only the patent No. 1,084, which is for the product.

The claims of the patent reissued to Charles Goodyear, deceased, in 1849, are as follows:

"What I claim as my invention and desire to secure by letters patent, is the curing of caoutchouc or India rubber by subjecting it to the action of a high degree of artificial heat, substantially as herein described, and for the purposes specified.

"And I also claim the preparing and curing the compound of India rubber, sulphur, and a carbonate or other salt, or oxide of lead, by subjecting the same to the action of artificial heat, substantially as herein described."

The claim of the patent for the product is thus expressed:

"What is claimed as the invention of Charles Goodyear, deceased, is the new manufacture of vulcanized India rubber (whether with or without other ingredients), chemically altered by the application of heat, substantially as described."

The specification, among other things, contains these clauses:

"For many purposes the manufacture is improved by the addition of other substances than sulphur, among which white lead is one of the best, and which, when used, may be combined in the mixture above described, in the proportion of seven parts by weight, thereby forming a triple compound. Other salts of lead may be used with advantage, and coloring may be also incorporated with the mixture for the purpose of imparting colors to the product.

"And other materials, such as cotton, silk, wool or leather, may be incorporated or combined with the India rubber and sulphur, thereby modifying the strength, elasticity or other qualities of the new manufacture for particular purposes; as it is found that the new substance or product will be produced whenever the essential elements of rubber-sulphur and heat are used, whether such other materials are incorporated or not."

A patent should be construed in a liberal spirit, to sustain the just claims of the inventor.

This principle is not to be carried so far as to exclude what is in it, or to interpolate anything which it does not contain. But liberality, rather than strictness, should prevail where the fate of the patent is involved, and the question to be decided is whether the inventor shall hold or lose the fruits of his genius and his labors (Corning vs. Burden, 15 How., 269; Battin vs. Taggart, 17 How., 74). The surrender was made by the executor for the reason that the specification was defective and required amendment.

This the law permitted if the facts brought the case within the provisions of the statute. The commissioner was charged with the duty.

of examining the facts and deciding upon the application. His judgment is shown in the results. Upon comparing the context of the specifications of the surrendered and of the reissued patent, and giving to each a reasonable interpretation, we are satisfied that the decision was correct, and we see no reason to reverse it.

It is the right of the patentee and his representatives to enlarge or restrict the claim so as to give it validity and secure the invention (Battin vs. Taggart, 17 How., 84).

Patentable subjects, as defined by the patent law (Act of 1836, sec. 6), are "any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvement on any art, machine, manufacture or composition of matter."

A machine may be new and the product or manufacture proceeding from it may be old. In that case the former would be patentable and the latter not. The machine may be substantially old and the product new. In that event the latter and not the former would be patentable. Both may be new or both may be old. In the former case both would be patentable, in the latter neither.

The same remarks apply to processes and their results. Patentability may exist as to either, neither, or both, according to the fact of novelty or the opposite. The patentability or the issuing of a patent as to one in nowise affects the rights of the inventor or discoverer in respect to the other. They are wholly disconnected and independent facts. Such is the sound and necessary construction of the statute.

This objection to the patent, we think, is also not well taken.

The principles of construction established in *Mowry* vs. *Whitney* (14 *Wallace*, 620, *pp.* 645–6) and should be applied to the interpretation of these specifications.

Comparison of the Specifications of the Original and Reissued Patents.

In order that a thorough comparison of the specifications of the original and reissued patents can be made by the court, they are here reprinted in such a manner as to show every change, omission, insertion or addition. What has been omitted from the original specification is printed in Italics, what is substantially retained in each is printed in Roman, and what is new in the reissued specification is printed in Italics.

Specification of Watt & Burgess' Original Patent 1854.

The Schedule referred to in these Letters Patent, and making part of the same.

To all whom it may concern:

Be it known that we, Charles Watt, of the city of London, in the county of Middlesex, and Hugh Burgess, of the city of London, in the county of Middlesex and Kingdom of Great Britain, have invented, made and applied to use certain improvements in pulping and disintegrating vegetable substances, for which letters patent have been granted to us by Her Majesty the Queen of Great Britain, bearing date the day , one thousand eight hundred and . And we do hereby declare that the following Specification (*being the same on which letters patent were granted*) is a full, clear and exact description of the same.

The wood or vegetable substances upon which it is intended to operate by this process should first be reduced to *very fine* shavings or cuttings, *the finer the better*. This may be done in any suitable machine.

The shavings are then to be boiled in a solution of caustic alkali, the strength of which, being dependent on the nature of vegetable substances operated on, *can only be learned by experience*. For deal or fir wood we find that a solution of alkali of the strength indicated by twelve degrees of the English hydrometer answers very well. The length of time necessary for this part of the process is somewhat dependent on the nature of the vegetable substance to be treated.

We find boiling in a solution of caustic alkali under pressure of considerable service.

We do not claim this operation as a part of our invention.

The shavings are then to be well washed and pressed; and the washings may be saved and evapo-

rated down, and burned in a suitable furnace, when they are again available for the same purpose.

The *damp shavings* are now to be exposed to the action of chlorine, or the compounds of chlorine with oxygen, till on a portion being placed in a dilute solution of caustic alkali, the vegetable substance falls into a dark pulpy mass. This part of the process is conveniently effected by placing the *damp shavings* on racks or drawers, *about nine inches apart, one above another*, arranged in a chamber, and allowing the chlorine, or the compounds of chlorine with oxygen, to enter the chamber and fill it. Of the compounds of chlorine with oxygen, we prefer that known as protoxide of chlorine, or hypochlorous, or chlorous acid, or euchlorine. If found more convenient, the chlorine, or the compounds of chlorine with oxygen, may be used in aqueous solution, instead of the gaseous form.

As soon as the shavings have been sufficiently acted upon by the gas, as may be ascertained by the method above described, they may be removed, and the hydrochloric acid which is the result of the above process, removed by washing, and the shavings well pressed. This should be done with as little water as possible, as this acid may be saved and made use of for the reproduction of chlorine. The shavings are now to be placed in a weak solution of caustic alkali, when they will fall into a pulpy mass of dark brown color. *This part of the process may be expedited by exposing this mass to the action of a beater or "engine," placed in a tank containing the solution of alkali.*

The pulp thus obtained as above described, having been freed from the alkali by washing (which may be saved as before directed), may now be bleached by the usual process, or, as we prefer, by chlorite or hypochlorite of soda or potash, liberating the chlorous or hypochlorous acid by hydrochloric acid.

Having thus fully described the nature of our invention, and shown how the same may be reduced to practice, we

wish it to be distinctly understood that we do not confine our claim to the apparatus, or utensils, or the manipulations herein named, as they may be varied to suit the circumstances of the case.

But what we do claim as of our invention, and desire to secure by letters patent, is the pulping and disentegrating of shavings of wood and other similar vegetable matter, for making paper by treating them with caustic alkali, chlorine simple, or its compounds with oxygen and alkali, in the order substantially as described.

CHARLES WATT and HUGH BURGESS.

THE REISSUED PATENT TO LADD & KEEN OF OCT. 5TH, 1858.

The Schedule referred to in these Letters Patent, and making part of the same.

To all whom it may concern :

Be it known that Charles Watt and Hugh Burgess, of London, England, did invent, make and apply to use, certain improvements in pulping and disintegrating vegetable substances, for which letters patent have been granted to them by Her Majesty the Queen of Great Britain, bearing date the 19th of August, 1853 : and we do hereby declare that the following is a full, clear and exact description of said invention, and the mode of carrying out the same.

The wood or vegetable substance upon which it is intended to operate by this process, should first be reduced to very fine shavings or cuttings, the finer the better; this may be done in any suitable machine. The shavings or vegetable substances are then to be boiled in a solution of caustic alkali, the strength of

which being dependent on the nature of the vegetable substance operated on, can only be learned by experience. By the "nature of vegetable substance" is meant its gummy or resinous nature, or its absence from such substance. For deal or fir wood, which contain resinous matter, a solution of alkali of the strength indicated by 12° of the English hydrometer answers very well. The length of time necessary for this part of the process is somewhat dependent on the nature of the vegetable substance to be treated—that is, its resinous or gummy nature, and boiling in a solution of caustic alkali under pressure is of considerable importance. By the words "*under pressure*" *is meant a pressure at, near or above* 300 *degrees of Fahrenheit's scale—the ordinary pressure used by us being from* 300 *to* 500 *degrees, in accordance with the nature of the substance to be treated.*

The shavings or vegetable substances being pulped, are then to be well pressed and washed; the pressings and washings may be saved and evaporated down and burned in a furnace suitably constructed, when they are again available for same purpose.

The damp mass of materials being pulped, are now to be exposed to the action of chlorine, or the compound of chlorine with oxygen, *and can then be made into white paper if the material used was not of a highly resinous nature.* If the material under treatment was of highly resinous character, it should then be washed and placed in a dilute solution of caustic alkali—warm preferred; the vegetable substance then falls into a dark pulpy mass, and when washed can be bleached by any desirable method known. *Good white pulps will be obtained by the above processes, according to the resinous or non-resinous properties of materials under treatment, and the pulps will retain their clear appearance for any length of time in their pulpy state or after they are made into paper.*

The above described gasing or bleaching process is conveniently effected by placing the damp shavings,

vegetable substance or pulpy mass on racks, or drawers about nine inches apart, one above another, arranged in a chamber, and allowing the chlorine or the compounds of chlorine, with oxygen, to enter the chamber and fill it. Of the compounds of chlorine with oxygen, we prefer that known as protoxide of chlorine or hypochlorous or chlorous acid, or euchlorine. If found more convenient, the chlorine or the compounds of chlorine with oxygen may be used in aqueous solution, instead of the gaseous form; as soon as the shavings, vegetable substance or pulpy mass have been sufficiently acted upon, the time required being as to their resinous or non-resinous properties, they may be removed, and the hydrochloric acid, which is the result of the above process, removed by washing and well pressing the materials under process. This should be done with as little water as possible, as the acid may be saved and made use of for the reproduction of chlorine.

When the pulp obtained by the above described process has been freed from its alkali by pressing and washing (which pressing and washing liquid may be saved as before described), it may be bleached by the usual process, or, as we prefer, by the chlorite or hypochlorite of soda or potash, liberating the chlorous or hypochlorous acid by hydrochloric acid.

Having thus fully described the invention of said Watt & Burgess, what we claim as of their invention and desire to secure by letters patent is, the pulping or disintegrating of shavings of wood and other similar vegetable matter, for making paper in the manner substantially as herein described, according to the nature of the vegetable substance to be treated.

WILLIAM F. LADD.
MORRIS L. KEEN.

Specification of Watt & Burgess' Reissue (1449), April 7, 1863.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that Charles Watt and Hugh Burgess, of London, England, did invent, make, and apply to use, certain improvements in pulping and disintegrating wood and other vegetable substances, for which letters patent were granted to them by her Majesty the Queen of Great Britain, bearing date the 19th of August, 1853, and we do hereby declare that the following is a full, clear, and exact description of said invention, and of the mode of carrying out the same *in practice.*

The wood or vegetable substances upon which it is intended to operate by this process should first be reduced to shavings or cuttings. This may be done in any suitable machine. The shavings *or cuttings of wood, or the vegetable substances,* are then to be boiled in a solution of caustic alkali, *in a suitable boiler, under pressure.* The strength of the alkali is dependent upon the nature of the vegetable substance used and operated upon. *For non-resinous woods, a solution of alkali of the strength indicated by seventeen degrees of the English hydrometer, or thereabouts.* answers very well, and for deal, *pine* or fir wood, *or other woods containing resinous matter,* a strength of about twelve degrees *is sufficient, but varying with the nature of the vegetable substance being acted upon, to a strength of about ten degrees.* The varied nature of the vegetable substance to be acted upon is such that only general direction can be given for the strength of the alkali, or the degree of heat to be used or the duration of the operation. Boiling in a solution of caustic alkali under pressure is of *essential importance. By the words "under pressure,"*

is meant a pressure at, near or above three hundred degrees of Fahrenheit's scale, which is the ordinary pressure used; but a heat and corresponding pressure of from three hundred to five hundred degrees may be used, according to the nature of the vegetable substance to be treated—whether resinous or non-resinous, or otherwise—and the time may be from four to twelve hours, according to the nature of the substance.

After the vegetable substance has been thus operated upon by caustic alkali, under heat and pressure for the requisite time, as above described, it should be discharged from the boiler, while under pressure, into a tank or other reservoir, with proper safety valves and pipes for the discharge of the steam, and should be drawn as soon as the steam shall have escaped, into open vats where it can be operated upon in the next stage of the process, or it may be drawn directly into the vats from the boiler. The vats which receive the wood shavings or cuttings, or other vegetable substances being formed into pulp, should be constructed with suitable means of drainage.

The alkaline solutions must then be removed from the pulp, either by percolation and subsequent washing in the vats, or by pressure in any convenient apparatus, and subsequent washing. The mode of percolation has generally been found sufficient. The alkaline solutions thus obtained may be saved and evaporated down, and the residuum burned in a furnace suitably constructed, so as to prepare the alkaline substances for use in a repetition of the same process.

The alkaline solution having been removed by percolation and washing, *or by pressure and washing, the wet mass of vegetable or woody pulp* is now to be exposed to the action of chlorine, or the compounds of chlorine with oxygen, *for the purpose of bleaching it and preparing it for the manufacture of white paper. Brown, colored or unbleached paper, of a good quality, can be produced from the pulp as soon as the alkaline solutions are removed; but for the production of good white paper it is necessary to subject the pulp to the bleaching process.*

If the material used be wood or vegetable substance of a non-resinous nature, the pulp may be bleached by subjecting it to the action of chlorine in a gaseous form, or, which is preferable in this case, in an aqueous solution, in any of the common and well-known modes.

If the wood or vegetable substance be of a resinous nature, the alkaline solution should be removed by the mode above described, and the pulpy mass should be exposed to the action of chlorine or its compounds with oxygen. This may be done by placing the *pulpy mass of woody or vegetable substance* on racks or drawers arranged in a chamber, and applying chlorine, or its compounds with oxygen in the gaseous form, *which with resinous substances* is preferable to the aqueous solution, until the mass is sufficiently acted upon. The mass must then be again well washed and treated with a weak solution of caustic alkali, warm preferred, which changes the red color to a dark brown. The alkaline solution should then be removed by washing, and the resulting gray pulp may be bleached by any ordinary method of bleaching.

What we claim as the invention of Charles Watt and Hugh Burgess is, first:

The process of treating wood or other vegetable substance, by boiling it in alkali under pressure, as a process, or preparatory process, for making pulp for the manufacture of paper from such woods or other vegetable substances, substantially as described.

We also claim the process of treating resinous woods by boiling in an alkali under pressure, and treating the product with chlorine and its compounds with oxygen, for making white pulp for the manufacture of paper from such woods, substantially as described.

Claim of Product Patent—No. 1,448.

What we claim as the invention of Charles Watt and Hugh Burgess, *as a new article of manufacture, is a pulp*

suitable for the manufacture of paper made from wood or other substances, by boiling the wood or other vegetable substance in an alkali under pressure, substantially as described.

THE REISSUES OF 1863 WERE RIGHTFULLY TAKEN, AND ARE VALID.

The first requisite in every reissue is, that it should be for the sam invention as the original, and the first inquiry under this requisite has been held to be whether the specifications are consistent, or whether there is any positive conflict or inconsistency between them as a matter of law. (*Sickles* v. *Evans*, 2 *Fisher, P. C.*, 417–437; *Carhart* v. *Austin*, 2 *Fisher, P. C.*, 543, 551–2; *Goodyear* v. *Providence Rubber Co.*, 2 *Fisher*, 299.) Whether this proposition is correct as applicable to all cases of the reissue of patents as well those of chemical as of mechanical inventions, may be questioned, but it is not important to question it in the present cause. The specifications of both the original and reissued patents relate to the manufacture of paper pulp from wood by purely chemical agencies. The pulp thus manufactured is identical in each. The chemical agencies are the same —heat and alkali, with or without chlorine; and the sole question is whether the inventor had the right to give the directions for the use of these agents, which we find in the reissues, for the production of the same article, the paper pulp described in the original specification, and claimed as a new product in reissue No. 1,448.

The reissues are, in point fact, only more precise descriptions of the same invention and of the mode of working it.

The original specification of the American as well as of the English patent was defective in many particulars, among which are the following:

1st. It did not set forth with sufficient distinctness the strength of the alkali to be used. This strength,

it says, "being dependent on the nature of the vegetable substances operated on can only be learned by experience." It merely indicates that a certain strength for deal or fir-wood "answers very well."

2d. It does not set forth the length of time for which the boiling must take place, either for the open boiling or the pressure boiling. It is said to be "dependent on the nature of the vegetable substances to be treated."

3d. When boiling under pressure is used, it does not state the amount of pressure or the degree of temperature which is found best fitted for pròducing the result.

4th. It does not distinguish clearly between the results of the open boiling and of the pressure boiling.

5th. It does not give directions for the treatment of any other than resinous woods, "deal or fir."

6th. It does not set forth and claim the product, "*the pulp obtained*," as a new manufacture.

7th. It does not claim separately both the open boiling and the pressure boiling.

8th. It errs in using language concerning pressure boiling, which might be construed into a disclaimer, not only of the discovery of it, but of the advantages of its use.

Some portions of the specification are so uncertain and indistinct, that it is doubtful it it could have been sustained on account of its not giving sufficient directions for the use of the invention; and for the other reasons it might, too, have been declared inoperative

and invalid (*Tyler* v. *Boston*, 7 *Wallace*, 327). The reissue of 1868 (*pp.* 375–378), was designed to correct many of these uncertainties and omissions, and the carefully prepared reissues of 1863 were intended to remove the whole of them.

We now proceed with the comparisons:

The first variation, about the size of shavings or cutting, is of not the slightest importance.

In the variations from the next paragraph of the original specification, four of the eight points in which this specification was defective are attempted to be corrected.

1st. The omission to state the difference in treatment required between resinous and non-resinous woods.

2d. The omission to state the strength of the alkaline solutions required for the two kinds of woods.

3d. The omission to state with precision the kind of vessel in which the boiling should take place; and

4th. The omission to state whether pressure or open boiling was the best.

Thus the first new phrase of any significance directs that the boiling should take place "in a suitable boiler, under pressure." The second points out the difference in the treatment of resinous and non-resinous woods, and indicates the strength of alkali for each. The omission to state the different mode of treatment required for non-resinous woods was a clear defect which it is the province of a reissue to supply.

The next alteration is the substitution of the words "essential importance" for "considerable service." The words "service" and "importance" are used as synonymous. When the quickest and most economi-

cal, and consequently the best mode of using the invention, was by pressure boiling, the word first used was calculated to mislead, and it was the duty of the inventor to substitute a word which should not mislead. This is the whole effect of that alteration, which appears also in the first reissue.

Then follows a definition of the words "under pressure," which were in both the original and reissued patents, and a clause supplying an omission in the original patent by giving a direction as to the time of conducting the operation. Without these amendments the original patent might have been declared inoperative and void.

"Pressure" in performing the operation indicated in the original patent could only be caused by heat, and if they knew the degree of heat, or the number of pounds of pressure corresponding to the degree required for effecting the chemical changes, they were bound to set forth either one or the other or both, at the peril of losing the protection of their patent. If they did not know either at the time of taking their patent, but learned one or both from experience in working their invention, it was their duty to surrender the patent and amend the specification so as to include the knowledge which they had thus acquired. This is just what has been done in this case and no more; "under pressure" is a vague and indefinite phrase, and is now defined so as to be clear and certain in its meaning. The length of time, which was left also indefinite in the original specification, is made as specific as possible. A minimum and maximum are given both for the degree of heat and the length of time. This amendment was made on the first reissue.

The next addition is of a direction of the best mode of removing the pulp from the boiler. This is no part of the invention or of the claims. It is merely directory as to the best mode of performing an operation incident to the use of the invention. It is a method of discharging the contents of the boiler which has been

in use since the operation at Gray's Ferry. It is described in Mr. Burgess' note-book among the experiments following December 7, 1854, and the entry must have been made in the month of December, 1854, because operations there were abandoned in January or early in February, 1855.

BOILING ACCOUNT (E.)

"Stock 200.

"Alkali sixty gallons, thirteen Beaumé, sixty degrees very nearly caustic, boiled five hours, stock loose but not pulped; added forty-eight gallons of eight Beaumé boiled eight hours.

"Stock soft but not quite pulped; *if blown out with a head of steam would have pulped.*"

It is a useful direction to the workmen, nothing more.

The phrase "we do not claim this operation as a part of our invention" is dropped altogether. It means simply that they do not claim to have been the inventors of pressure boiling, and as no such pretension is made in the claim proper, it is mere surplusage in the specification. Burgess in his testimony (*p.* 86, *int.* 25) thus accounts for the use of this phrase in its original specification:

"After preparing the rough draft of specification, I was impressed with the idea that I should invalidate our patent if I broadly claimed pressure boiling as a part of my invention, as I was aware that simply boiling substances under pressure, as a process, was not new. I had also ascertained that a process existed for boiling rope and rags under pressure, though at too low a temperature to pulp wood. I had never heard of the process of boiling under pressure being used to pulp vegetable substances. In the specification finally decided on, I disclaimed the process of pressure boiling, as a process, as my invention; but I believed I had so expressed myself as to claim as our process the boiling wood in caustic alkaline solutions, both under and without pressure; the amount of pressure to be used being determined by the subsequent chemical treatment of the boiled wood or pulp, as the nature of the wood should determine."

And also (*p.* 130, *Cross-int.* 150): "At the time of my applying for the patent in 1854, I believed that no one had ever thought of using alkali in boiling under pressure for the purpose of disintegrating vegetable substances. I thought the idea a perfectly novel scientific fact,

and in my ignorance of patent matters at that time, I thought I only had to refer to it to entitle me to its use for the above purpose; but as I knew that boiling under pressure, as a process, such as the boiling of cotton, rags and waste, *et cetera*, under pressure, for the purpose of destroying the mordants of the dyes, and grease and dirt, and that a small close boiler was well known as Papin's digester, I used the words 'we do not claim this operation as a part of our invention;' those words badly explaining the idea I wished to convey."

In the original specification several phrases are used for one and the same substance. In the introduction the invention is said to consist of "improvements in pulping and disintegrating vegetable substances." In the claim it is "the pulping and disintegrating of shavings of wood and other similar vegetable matter." In the first paragraph of the specification the material is spoken of as "shavings or cuttings," and as "shavings" alone, and again as "damp shavings;" and the result is spoken of as "a pulpy mass of dark brown color, and as "the pulp thus obtained." In the amended specification the synonymous phrases of "wood and other vegetable substances" and "wet mass of woody or vegetable pulp," are uniformly used. This is but a formal variation.

The remainder of the amended specification is a further direction about the treatment of resinous and non-resinous woods. Non-resinous woods will be pulped at this first stage of the operation, and the pulp may be at once bleached and run into paper. For resinous woods the subsequent treatment is substantially the same as in the original specification. The most careful examination will not detect any material difference.

The second claim of the reissued patent is also substantially the same as that of the original patent, with the addition of the words "under pressure." The same reason existed for inserting the words here as in the direction about boiling. The second washing in alkali without pressure, was found to be of no importance, and it does not appear in the claim, although described in the specification.

The first claim is for the first boiling process, by which non-resinous woods are pulped, and which is the "preparatory process" in the pulping of resinous woods.

No new or distinct invention is inserted, but the fact is stated that with regard to non-resinous woods, the first treatment with alkali and a high degree of heat is sufficient to produce the pulp, and that the chlorine treatment is unnecessary. What the original specification describes as necessary for all kinds of wood, is by the amended specification confined to such woods as are mentioned in the original, viz., "deal and fir," and other resinous woods, and is stated not to be essential for non-resinous woods. The amendment consists in teaching the workman, while working with non-resinous woods, to omit certain originally described operations as unnecessary. This proves, therefore, that the case was preëminently one for a reissue within the 13th section of the Act of 1836, for, "by reason of a defective or insufficient description or specification," the patent might have been declared inoperative and invalid for the protection of the process of making pulp from non-resinous woods. The original patent took for its field of invention all kinds of wood; the reissued patent defines with greater precision the treatment for different kinds of wood, and the product, the result, remains the same—a wood pulp suitable for the manufacture of paper. By using more specific language in the reissue, the invention is narrowed, not enlarged.

Instead of the insertion of a new and distinct invention in the reissue No. 1449, a substantive invention capable of supporting a third claim, or a reissue in a third form has been entirely omitted. That is the invention of producing pulp from wood, by the process of open boiling without pressure in alkali and subsequent treatment with chlorine alone, or chlorine and alkali. This process had been a success so far as the mere production of pulp was concerned, but it was not, and could not be made a commercial success, so

far as the business of manufacturing paper pulp or paper was concerned. In this respect it stood upon the same footing as the Coupier and Mellier invention, which was just patented in France and not made public till after Watt & Burgess' experiments had been completed.

THE REISSUE IS NO MORE THAN A DISCLAIMER IN ALL POINTS BUT ONE.

There cannot be any pretence, therefore, that these reissues were taken for the purpose of making the claims more broad, or to include the subsequent inventions of others. No one has been named who has succeeded in making paper from wood by chemical agencies, either before or since the date of the Watt & Burgess patent. It will be difficult to find a reissued patent in which the claim follows the original more closely than the last claim of this process patent. As pressure had been mentioned as useful in the original specification, the words "with or without pressure" might have been rightfully inserted, as it has already been shown that they were necessarily implied in the original claim. The amended claim omits what is superfluous in the original, and retains only what is necessary. It omits the open boiling as an unprofitable process, and the final treatment with weak alkali as unnecessary and useless. This last washing in weak alkali, "warm preferred," was no part of the chemical process, as the alkali produces no effect upon the wood unless boiling. To speak of it as a chemical process, or to claim it as a substantial part of the invention, would have been delusive. It was, therefore, rightly dropped.

The phrase "tri-stage process," or "tri-step process," as applied to the original description, is also delusive. It is properly a dual, or two-stage process. The first is the action of the alkali, the second, of the chlorine. Although an alkaline solution is twice used,

yet it only once acts as a chemical agent. Where the process is spoken of as of three stages, the first and third terms are the use of alkali in some form, and the second the use of chlorine. The middle term is found to be unnecessary, or useful only in treating resinous woods; to retain it in the specification would misguide those who sought to use the invention. The reissued specification was properly amended to avoid this objection that might have been made to the original. The patentee finds that he has described and claimed too much; and in order to have protection for what he did invent, it is his duty to go to the Patent Office and say: "I find that, as an agent for removing the interstitial matter of non-resinous woods, chlorine is unnecessary. I ask a patent for what I have done, and what I continue to do." This he might have done as well by a disclaimer as by a reissue.

In claiming the process, both with and without pressure, in his original patent, one method was claimed which was found useless. Suppose the first idea of taking a reissue was for the purpose of dropping the claim for the open boiling, the method by pressure boiling alone would remain. "Boiling under pressure" would then become of "essential importance" instead of "considerable service." The patentee would then be asked, what do you mean by boiling "under pressure?" It became necessary to define it in order to perfect the amended specification. Hence the particularity about the strength of alkali, degree of temperature, and length of time of the operation. Precision of statement with regard to each of these narrows the scope of the invention. If it be urged that the reissued patent would have been invalid without such precise description, that argument would afford the reason for his right, as well as his duty, to insert these definitions and directions. These are the details of the elements of the process. Burgess says, that at the

outset he had no means of measuring, even approximately, the degree of pressure or temperature. In his laboratory he had no steam-gauge, no suitable thermometer, in fact no instrument for measuring any of these elements, except a hydrometer. When he commenced work at Gray's Ferry, in August, 1854, he could only measure the maximum of the temperature used, from the fact that the safety-valve of his boiler had been set to blow-off at 120 lbs. But his new boilers at Royer's Ford were constructed with proper steam-gauges, and he there made the measurements which he put into his first reissued patent.

In fact there is nothing with regard to the use of chlorine and the second use of alkali, two steps of the "tri-step process" that might not have been cured by a *disclaimer*. It was competent and proper for the patentees, when they discovered that the use of chlorine was unnecessary for the non-resinous woods, and when a very high range of temperature is used for resinous woods, to have cured this overclaim, and also the claim to the washing in warm alkali, which is entirely useless, by filing a short and simple disclaimer in the Patent Office. The open boiling process also might have been abandoned by a disclaimer. The only purposes for which a reissue was necessary, were to define more clearly the strength of alkali, the degree of temperature and the time of the operation, which were left in such uncertainty in the original specification. This was not only legitimate and proper, but was absolutely required by the statute.

One of the learned judges of the court in the third circuit seems to consider that the measurement of the graduation and adjustment of the strength of alkali, heat and time, are essential parts of the invention, and that it was not complete until these were ascertained. He says it is the misfortune of the complainants that Burgess did not apply for an independent patent in the latter part of 1854.

Judge Cadwallader says :

"The patentees did not intend to describe, or to claim, any process completed at one operation, to which boiling under pressure was indispensable. It may be said that there is, nevertheless, no absolute impossibility that they had invented such a process; and that the legal question under the reissue is not what they had intended to patent, but what they had, in fact, invented. This, in the abstract, is true. But its mere legal truth does not lessen the immense improbability that they had, in fact, invented or discovered the process."

It is submitted that, under the rule of law thus admitted, the question is not one of "improbability," "immense" or otherwise, but one of fact. Had a process been discovered by the inventors prior to the date of their English patent, by which pulp had been produced at one operation? Upon the testimony of Burgess, supported by his specimens, his memorandum book and his original draft specification, there can be no doubt of this fact. The opposite theory is the improbable one, if there are probabilities to be weighed where the testimony is positive. If Burgess had been conscious of having made a new invention, it is probable that he would have been in equal haste to protect it by a patent, as he was with the first; and it is probable, also, that if he could conscientiously have done so, that he would have taken his new patent and made sale of it, and retained the entire consideration of the sale to himself, instead of turning over a portion of what he received to Watt (*pp.* 113–114, *ints.* 25–26).

Are his notes genuine, and is he a credible witness? If yea, then the reissues are properly taken. His testimony is not shaken by cross-examination, nor contradicted by a single witness, nor is the genuineness of his notes contested. Who but himself should know when his invention was complete? The suggestion of Judge Cadwallader is, that Burgess might have taken out a patent for the single operation in the latter part of 1854, independent of Watt, and that such patent would be good. But this is a matter on the conscience of Mr. Burgess alone. Could he have

sworn with truth that this was his sole invention in 1854, when he had actually done the thing with Mr. Watt prior to August, 1853? Not if he has now told the truth, and it is not to be presumed that he has voluntarily told a falsehood. His own testimony would have defeated any such patent. The true point is, that this invention was complete as soon as perfect pulp had been produced by either of the described processes—by a single boiling in alkali, at a high temperature, or by a boiling in alkali with the subsequent chlorine treatment. It is not necessary for a chemical inventor to verify his results on a large scale before his invention is complete and patentable. He may be satisfied that it is so by his laboratory experiments and his knowledge of the laws of chemical science. This was the case with Derosne's invention (*Webster's P. C.*, 152).

The invention is complete with him when he is satisfied with his results, and the world cannot question the date which he assigns for its completeness, when he proceeds to carry out his ideas, and without cessation or change in its workings, produces a new, valuable and great manufacture. For however closely Mr. Burgess' testimony might be criticised, if there were a rival invention claiming to antedate him in this case, it is here only a matter between Watt & Burgess and those who use their invention not being inventors or claiming under any rival invention. If Watt & Burgess ante-date their invention in this case, it is for the public advantage, not their own, for they thereby shorten the term for which their monopoly might have been secured. Between 1851 and 1854, there is no person named in this record as a contestant with Watt & Burgess for the honor of this great invention.

But this fallacy rests in part upon the erroneous views taken by that judge about the product patent. He fails to perceive that the invention was as complete when the pulp was taken out of the mercury bottle as it is to-day. The thing sought for had been obtained.

A process was discovered of obtaining it. There might be a dozen other processes subsequently discovered, all essentially different, for obtaining the same thing, and each of them might be the subject of a separate patent. But if the original process is put into use, and can be described with sufficient certainty, it may be the subject of a valid patent, notwithstanding the discovery of the new processes. The true question, it is submitted, is whether the original experiments were such as to enable the inventor to practise his invention and state the conditions of it intelligibly, and whether he has done more than to make a more accurate description of these conditions in his reissued patent. Of course Watt and Burgess did not know, and no other chemical inventors have ever known, all the conditions, and hence not the best conditions, for the practical use of their inventions, at the time when they first undertook to describe them. There is not an original patent for a chemical invention of any value that has not been defective, and requiring reissue or disclaimer, for the reasons already stated. It is too much the custom with such inventors to rush at once to the Patent Office and obtain a patent upon crude and insufficient experiments and statements. But, as a general rule, the inventor knows better than any one else when his invention is accomplished, when his experiments cease and his knowledge begins, and in the absence of fraud or of any conflicting interest, his statement should be conclusive.

Another error of the adverse opinions is in confounding the weights, measures and details of the process which were the result of observation, with the invention itself. The process was completed before the hydrometer, the thermometer, the pressure gauge or the chronometer were applied to it. When the inventor discovered that perfect pulp could be produced in a short time by the action of alkali and high heat upon wood, at one operation, the invention had been accom-

plished. The subsequent graduation of these elements, to obtain the most economic result, might have been done by other persons as well as the inventor. They are merely methods of working the invention, which might have amounted to improvements, but which do not alter the character of the invention itself. And it sounds most strangely illogical to say that an inventor must lose the rewards due to a great and most valuable discovery because he has in a reissued patent described with the particularity which the law requires him to do the best methods of working his invention.

It is my view of the law that when an inventor, and especially a chemical inventor, finds in the course of working his invention that he can give a better description of the details of it than he originally was able to give in his specification, that it is not merely his privilege, but his *duty*, to surrender the original patent and take a reissue containing the more perfect description. If the inventor had known all the conditions of the most successful working of his invention at the time of preparing his original specification, and had omitted to set them forth, and stated that they must be found out by experiment by the persons using the inventions, then, undoubtedly, the patent would be void. But when the invention and discovery were completed, and were actually worked by the inventor, although the best conditions were unknown to him, and he gave honestly the best description he could at the time, and he afterwards, in bringing his invention into use, finds that his description can be improved, such correction is imposed upon him by the law as the condition of retaining the privileges conferred by his patent. Indeed it has been said by a learned judge (*French* vs. *Rogers*, 1 *Fisher P. C.*, 137) that "it is for the public interest that the surrender and reissue should be allowed to follow each other, just as often as the patentee is content to be more specific or more modest in his claims." And again (*p.* 139), after stating the op-

posing interests of the patentee and of the public, he says, "it is the purpose of the statute to reconcile this seeming conflict; and it effects it by allowing the inventor to amend the mistakes he has honestly fallen into in his description and claim of title as soon and as often as he discovers them."

The cross-examination of *E. S. Renwick* (*pp.* 320–324) exposes the fallacies of the theories of the defense.

Analogous Cases of Amended Specifications.

The changes in the specifications of the patents in the cases already referred to are more striking than those now before the court. Thus, in the Charles Goodyear patent, the original claim was for

> "The combining of the gum with sulphur and white lead so as to form a triple compound, either in the proportions herein named, or in any other within such limits as will produce a like result; and also the process of exposing the India rubber fabric to the action of a high degree of heat, such as is herein specified, by means of which my improved compound is effectually changed in its proportions, &c."

In the first re-issue a whole page or more of description is interpolated, describing the effect of sulphur alone, either in the form of gas or otherwise, upon the rubber, and a new claim founded upon it, which was sustained after one of the most severe and prolonged controversies ever had over any patent.

In the last reissue of that patent, sustained thus far in every circuit where it has been litigated, and recently sustained in this court, the triple compound entirely disappears, and the claim takes the following shape:

> "What is claimed as the invention of Charles Goodyear, deceased, is the new manufacture called vulcanized India rubber, which is a combination of India rubber with sulphur (whether with or without ingredients), chemically altered by the application of heat, substantially as described."

The changes in the descriptive part of the specifications are equally great. The last reissue of this patent

was in two parts, suggested by an opinion of the late presiding judge of the Third Circuit.

In the original patent of Thomas Hancock for the same substance, vulcanized India rubber, the description of the product and process is even more indistinct and uncertain than in that of Goodyear.

The changes in the patent of Nelson Goodyear for vulcanite or hard rubber, are even more striking. In his original patent he describes his invention as an improvement on that of Charles Goodyear for the soft vulcanized rubber. The original patent was for a process alone. It was surrendered for the purpose of being divided so as to claim the product as well as the process. This division was sustained in the cases heretofore referred to.

The original specification described the ingredients as sulphur and rubber in about equal parts by weight, and stated that a much less proportion of sulphur would not suffice; that a better result could be obtained by the introduction of magnesia in place of one-half of the sulphur. Other substances were named as useful to be added, and the result was stated to be a "hard substance." The method of curing was stated to be that of Charles Goodyear, and the heat was required "*to be raised as high as* 260° or 275° Fahr., and the time of exposure to the heat will range from three to six hours and even longer." The claim of the original patent was as follows:

"The combining of India rubber and sulphur, either with or without shellac, for making a hard and inflexible substance hitherto unknown, substantially as herein set forth."

And I also claim "the combining of India rubber, sulphur and magnesia, or lime, or a carbonate, or sulphate of magnesia, or of lime, either with or without shellac, for making a hard and inflexible substance hitherto unknown, substantially as herein described."

In the reissued patent the invention is declared to be an entirely different thing from the Charles Goodyear invention; "to have the spring-like property under flexure peculiar to whalebone;" that the pro-

portions of sulphur and rubber should be "one pound of gum to about from four ounces to a pound of sulphur," and that the heat should *not be less than* 260° to 270° *Fah.*," during a *period of six hours or more.* The claim of the reissued product patent is as follows:

"What is claimed as the invention of the said Nelson Goodyear, deceased, and desired to be secured by letters patent, is the new manufacture or substance hereinabove described, and possessing the substantial properties herein described, and composed of India rubber or other vulcanizable gum and sulphur, in the proportions substantially such as described, and when incorporated, subject to a high degree of heat, as set forth, and this I claim whether other ingredients be or not used in the preparation of the said manufacture, as herein described."

It will be observed that the variations here are far greater than between the original and reissued patents of Watt & Burgess, both in the description of the process and of the product. In the process the limit of the degrees of heat and length of operation is entirely reversed. That which was a maximum in the original becomes a minimum in the reissue.

In order to sustain the claim of the reissued patent, reference was had to the caveat cited by the inventor, and to testimony of witnesses who verified certain experiments of the inventor prior to obtaining his patent. Yet, with these alterations, the reissued patent has been sustained in all the courts, because the weight of evidence showed that the amendment conformed to the fact of the discovery, and that the best mode of working was described in the reissued patent. Both modes had been used before, but the inventor made a mistake in not describing the most perfect mode. He could not tell, as Watt & Burgess could not, at the time when they wrote their original specification, which would be the most profitable in actual use. Both described what they thought the most profitable, but which afterwards turned out to be the poorest and most expensive, and least satisfactory in its results.

The decisions of this court in the cases of *Burr* vs.

Duryee, 1 *Wallace*, 531, and *Case* vs. *Brown*, 2 *Wallace*, 320, have not varied the law of reissues as applicable to these patents. Here, the scope of the patent is contracted, and the mode of using the invention limited by more precise and definite language, instead of being expanded indefinitely as in the reissued patents which were declared invalid by these judgments. Our patentees should not be made to suffer for doing just the opposite to what is there condemned.

The sound sense of the law upon this subject is well stated in the opinion of the court in *O'Reilly* vs. *Morse*, 15 *Howard*, 62, *p.* 112:

"Variations from the description given in the former specification do not necessarily imply that it is for a different discovery. The right to surrender the old patent, and receive another in its place, was given for the purpose of enabling the patentee to give a more perfect description of his invention, when any mistake or oversight was committed in his first. It necessarily, therefore, varies from it."

The rules of construction, too, should be applied to the specification so as not to destroy, but to save:

"The whole instrument must be taken together, and a fair and reasonable interpretation given to the words used in it." (*Beard* vs. *Egerton*, 8 C. B., 165.) "In the construction of a patent the court is bound to read the specification so as to support it, if it can be fairly done."—Parke, B., in *Russell* vs. *Bowley*, 1 *Br. M. & R.*, 864.

It is submitted that no harsher rules should be applied to reissued specifications than to the originals.

Proof of Infringement.

McCracken (*pp.* 70, 71, *ints.* 4 and 5) describes the process in use at the works of the defendants, of which he was the superintendent. He proves the boiling of the raw material in an alkaline solution of a strength of from two and a half to three degrees Beaumé, and as high as five degrees, at a pressure of from forty to

sixty pounds, and for four hours. The result was a pulp fit to be worked into brown paper.

Burgess (*pp.* 80–83, *ints.* 4–14) describes the entire process at defendants' works. Being an expert, he proves the infringement (*pp.* 83–84, *ints.* 16–17).

Rand (*pp.* 90–91, *ints.* 7–8) also proves the infringement.

Townsend, superintendent of defendants' works, also testifies to the facts which constitute an infringement of both the Watt & Burgess and the Mellier patents (*P.* 147, *int.* 4; *p.* 148, *int.* 12; *p.* 152, *cross-ints.* 59–63; *p.* 153, *cross-int.* 73; *p.* 154, *cross-ints.* 77–79; *p.* 156, *cross-ints.* 102–103; *p.* 158, *cross-ints.* 140–146). He proves the use of an alkaline solution of 8° Beaumé, and upwards.

The Philosophy of the Invention.

Every chemical result is produced in obedience to some natural law which it is the object of that science to detect and make known. In the vast majority of cases the result is first observed; then scientific observation ascertains how and why such a result should be attained. If the Montgolfiers, Legoux, Dubochet, Gros and Wright had known the laws which govern the action of alkalies at a high temperature upon vegetable substances, they would undoubtedly have anticipated Watt & Burgess and Mellier in their inventions. Not that either Watt & Burgess or Mellier knew these laws when making their investigations, for their experiments were as empirical as those of their predecessors; but they first attained a complete and perfect result, and thus established the fact that they had set in motion these unknown laws. Mellier had studied their action until he had obtained some idea of the conditions necessary to their action prior to the taking out of his original patent in 1854, but he did not describe them with complete accuracy or precision until he filed the certificate of addition to his patent in August, 1855. Watt & Burgess knew that these laws acted within a wide range of conditions before they took out their

original patent, but they were able to describe only the maximum of their conditions in 1854, and the minimum, with the extent of the scope of the laws, when they had completed their observations with suitable instruments in the early part of 1856. This law is that caustic alkali, of a strength of from 2° to 4° Beaumé, at a temperature from 310° to 320° F., that is from about 70lbs. to 80lbs. internal pressure, has a stronger affinity for the intercellular tissues of straw and similar substances than for the cellulose, and will remove the whole of the ligneous and silicious matter, and leave the fibre in a fit condition to be made into paper, after a treatment under these conditions of from three to four hours; and that the same caustic alkali of a strength equal to from 8° to 12° Beaumé, at a temperature from about 300° to 375° F., has a greater affinity for the intercellular tissues of wood and woody substances than for the cellulose and fibre, and will remove the intercellulose and leave the fibre after a treatment varying from four to twelve hours under these conditions. The affinity was discovered, the result discovered, the pulp produced under the conditions of some high strength of alkali, a very high temperature, and a varying period of time, before the conditions themselves were weighed, measured and calculated, and consequently before they could be described with even approximate precision. But the invention was complete when the first perfect result was produced. These inventors, Mellier in France, working primarily upon straw, and Watt & Burgess, in England and in this country, working primarily upon wood, contemporaneously and without communication with each other, had produced results which had satisfied each that he was the author of a great invention, and they immediately sought the protection of the patent laws in their respective countries under such descriptions of the conditions under which their results were produced as they were then able to give. Both inventors have amended their original descriptions. Mellier did not

undertake to state the temperature or pressure with any certainty until he filed his English specification in October, 1855, when for the first time he designates his minimum as it now stands in his American patent taken out in 1857. These were clearly not new inventions, nor even improvements on the original invention. They were simply the results of observation upon the best modes of working the original invention, more consistent with the chemical laws which govern the affinities of the substances the inventor was using.

The law being now known, and also the conditions and limitations under which alone it can be brought into action, the reason for the failure of all the preceding experiments becomes apparent. No one of them ever attained the temperature of 300 *deg. Fah.* in their experiments for any length of time, and consequently no one ever set at work, in their requisite degree of strength, the affinities which enable the alkali to eat out of the wood or straw all the substances foreign to what is required for paper-making. Some of them, like Gros, Legoux, Dubochet, and the Montgolfiers, came very near it, but no one reached the minimum at which the chemical action is perfect. The difference may seem slight when expressed in pounds and degrees, but the difference between failure and success in inventions, as well as in the affairs of life, may seem to be slight, but it is really all the difference in the world. The reward is for the successful.

Essential Differences between Chemical and Mechanical Patents.

There are special reasons why these rules should be applied liberally to chemical inventions. Mechanical inventions deal only with the well-known mechanical powers and motors. The existing treatises on mechanics and the mechanic arts leave little to be discovered about them. The limits within which the

mechanical inventor works are clearly defined. His invention takes the form of a machine or combination, the structure of which can be seen and examined, its mode of operation is before the eye, and its whole scope, purpose and object are evident to the senses. If, in the combination of mechanism, he uses four devices to produce a given result, it is important to describe the structure of these devices and their mode of operation each upon the other. It is not only essential to describe the number of the elements of the combination, but the order and manner in which they act upon each other.

But the science of chemistry is yet young; even the number of its elementary substances is not yet known; and the laws which govern the action of each upon the other are but partially and imperfectly understood. The causes of the chemical attractions and repulsions, and the affinities which cause substances to unite and form a new substance, with properties entirely different from those of either of the component parts, have not yet been discovered. Only the fact is known that some substances will so combine and unite, and it is believed with certainty that an indefinite number of such substances yet remain to be discovered. It is not known why the ligneous and intercellular tissues of wood are more easily dissolved in alkali, and in some acids, than the softer and more porous cellular tissues; but the fact of such easier solution is known. When these chemical processes are to be carried on within close vessels, invisible to the eye, and with a high degree of heat and under pressure, it is difficult, if not in most cases impossible, to ascertain the manner in which the chemical combinations or reactions take place. A person may claim a new and useful composition of matter formed by the union of four ingredients, acted upon by heat in a closed retort. From the affinities of these substances, as he has observed them when mingled in open vessels, he may describe the process of making his new substance, by saying that A first unites with B, and this

compound with C, forming a triple compound which finally combines with D, when the new substance is completed; and he may take out his process patent in that belief. But the results of close investigations with improved means of observation, may show that the combinations take place in exactly the reverse order. The effect of heat upon the different substances may increase the affinity between A and D, and diminish that between A and B. What actually will take place can only be determined by careful experiment and close observation. In short, a valuable chemical invention may be made, without the discovery of the chemical law by which it is made. General directions for the working of such an invention could only be given in a specification, and much must be left to the experiments of the worker. The law which controls the invention may be discovered in the lifetime of such a patent, or it may not be discovered till centuries after. Yet the fact that a useful thing has been done, and that a practical way of doing it can be described, gives it the character of an invention, and entitles the person who has produced it to a patent.

Twenty or thirty years ago it was hardly possible to describe any chemical process with accuracy, and in the mode of taking out patents in vogue at that time, the preparation of correct descriptions in the first instance was the exception and not the rule. If we go back fifty years, before chemistry had become a practical science, every invention of that nature was described imperfectly. There are some cases of chemical patents in the reports, the most conspicuous of which is that which terminated in the House of Lords, under the name of *Heath* v. *Unwin*, in which the chemistry was all wrong. This case has left us but one useful idea, and that is that we know little . . out "chemistry at a white heat."

When, therefore, there is no willful concealment, no fraud, but an honest attempt to point out the best, and of course the most profitable mode of producing a new

and valuable chemical result, as in this case, I claim for the inventor the most charitable application of the beneficent provisions of the law.

Cellulose was known to chemists to exist in wood and straw. As Regnault says, it is "that constant substance which they regard as forming the cellular tissue of all plants." The substances used in the manufacture of paper, such as linen and cotton rags and cotton waste, were known to be pure cellulose. It was known how to eliminate cellulose from wood by laboratory experiments, as quoted from Regnault and Dumas. But the chemists did not intimate any uses to which the cellulose of wood could be applied. They chronicled the mere fact of its discovery, and the mode of proving the discovery. All that is claimed as the result of these experiments by Regnalt is that the resistance of the cellular tissue of plants to chemical agents is so great as to allow " its separation in a state of purity sufficiently perfect to permit the study of its chemical properties, and to ascertain its elementary composition." Nothing is stated as to its possible uses, nor was it certain that if it could be eliminated in large quantities that it would be fit for any useful purpose. Regnault wrote, several years after the experiments of Montgolfier, Legoux, Mege, Dubochet, Roque, Clothon Breuil, and Gros, his countrymen.

If their labors had been of any practical value, they would probably have been mentioned in a work as comprehensive as that of Regnault. But it is clear from what Regnault and Dumas say, that it was not known even in the laboratory, that cellulose, *perfectly pure*, and in any definite form, could be eliminated from the woody substances in which it was known to exist in some form. The form in which it might finally be made to appear, and the use which might be made of it, could not be determined by *a priori* reasoning. " Cellulose," says Dr. Cresson, " or woody fibre, starch, and dextrine, are identical in composition, differing only in the molecular arrangement, which molecular

arrangement affects their physical properties and chemical relations in much the same manner as is the case with carbon in its different states of charcoal, coal, plumbago, or the diamond. To obtain starch in a soluble form, it may be acted upon by oxygen, which by the elimination of carbon converts it into sugar, and nature most frequently stores its excess of food in the form of starch, to be redissolved and again deoxidized and converted into cellular structures. In the laboratory it may be heated to 300° F., which converts it into dextrine, soluble in cold water. If we add to cellulose or starch the elements of one equivalent of water we convert them into soluble gum, or into cane sugar; if we add the elements of four equivalents of water, we convert them into grape sugar."

It is with a substance as protean as this that our inventors were experimenting, and nothing but an experience greater than had been attained when Regnault wrote could determine what the result would be, *Rand* (p. 92, *ints.* 12–15; pp. 210–11, *ints.* 16–21), describes the constituents of plants, and the agencies, so far as known, by which the intercellulose can be removed. Nothing in the evidence of Rand and Cresson is left to conjecture. They have tested, by actual trial, every scientific fact to which they testify; and they have drawn upon the resources of microscopic photography to illustrate their explanations. From this evidence it appears that the intercellulose of the sap wood is more easily decomposed than that of the heart, that the portion of the intercellulose which is the most difficult to remove, and which cannot be removed by mechanical means, is what is called the "incrust," surrounding and firmly attached to the pure cellulose; that this incrust cannot be wholly removed by the action of alkali unless at a temperature above 300° F. (*Rand*, p. 210, *ints.* 11–16). Some portions of the incrust may be removed by the action of chlorine, but not by the ordinary bleaching process, (*Rand*, pp. 212-213, *ints.* 32–33). Bleaching does not affect the weight

of the material bleached, while the removal of the incrust produces a sensible diminution of weight. Hence, in no one of the experiments described in the books, and in the earlier specifications, has a pulp been produced from which a good white paper could be made by the ordinary modes of bleaching and felting.

Reasons for Montgolfiers' Failure.

The Montgolfiers met with this difficulty, and their confession shows why their experiment failed. They say:

"If this pulp is destined for white paper, it is necessary that immediately after alkaline treatment, the pulp should be washed in hot water to remove the dissolved resin, then submitted to a bleaching process, of which *we claim the right for application in paper-making.*

"The mode of bleaching consists in passing a stream of chlorine gas into a solution of caustic potash, under pressure, in which the pulp to be bleached is immersed. By this process a particular effect is produced *which science alone can explain in a satisfactory manner*, but which practically has afforded us incontestible results. In bleaching by the ordinary method, by chloride of lime or chlorine gas alone, it happens that the ligneous fibres retain but even so little resin dissolved by the previous alkaline action, that the chlorine brought into the preserving resin ceases to act and to remain without effect in the substance."

They say, in the first part of their specification, that they "refrain from showing here the process relating to bleaching *in vacuo*, to which we attach a secret patent, claimed for the discovery of this new patent pulp." What this new process was, "which science alone can explain in a satisfactory manner," has never been made known, and, consequently, the discovery of the Montgolfiers has come to naught. From their remarks about "resin," it is clear that they were not acquainted with the constituent elements of wood.

Reasons for Wright's Failure.

Wright not only did not attain the high temperature

necessary to put these affinities into action, but it was impossible for him to do so in the apparatus he describes (*Rand, pp.* 205–6). He does not mention any temperature above the boiling point, or any pressure above that of the atmosphere from the beginning to the end of his specification. What he did in England, in a few experimental operations which came to nothing, can have no effect upon either the patent of Mellier, or of Watt & Burgess. It is only what is described in printed publications that affect the validity of either patent, or be entertained as evidence in the question of novelty under the patent law. (*Gayler* vs. *Wilder*, 10 *Howard*, 477.) If we look at his specification, we see that he not only did not use heat and alkali for the purpose of pulping straw, but that he had no idea that these agents were effective in producing pulp. On the contrary, what he calls pulp is produced by other agencies, and by mechanical action. In his specification, he describes his pulping process: First, the "*tub*, or vessel A," contains a solution of lime, or "milk of lime." Steam is admitted into this "tub" "for the purpose of boiling water." (*Specification of* 1843, *p.* 362.)

"These *tubs* may be made of wood or metal, and are intended to contain the straw or other fibre in which it is to be boiled, with the lime liquor previously prepared. The said tubs to be covered down with lids and made steam-tight, with safety valves, which boiling process should continue for about twelve hours."

By means of pipes and valves, the "straw or fibre and liquor, when sufficiently boiled," are drawn off into the washing tubs CC. "After being well washed and cleansed, the straw or fibre has to be removed from this vessel and submitted to the grinding and pulping apparatus, DD, conveniently attached."

After describing this grinding apparatus, he says:

"The boiled straw or fibre from the tub C is now to be thrown into this trough, or bed, and under the roller, to which it is conducted by guides, and is allowed to remain under the guiding action of the rollers about fifteen minutes, more or less, as the nature of the material may require, *until the pulping process will be completed,* when *the pulp* may be taken out from under the rollers and placed in the tub E, which is of

the same construction, and used for a repetition of the same purpose as the tub C, &c.

"After this second washing, *the pulp* is to be passed through pipes and cocks into the close iron kiers FF, wherein it is to be boiled again in lime water, commonly called "milk of lime," as before, for about six hours. These kettles have steam-tight covers, safety valves, and manholes."

This is the first treatment under pressure, and it is evident that he supposes the pulping to have been completed during this pressure boiling in lime water, and before that in alkali, begins. The remainder of his process is for bleaching alone. Thus he pours "the pulp and liquor" into another set of tubs GG, and there washes it. Then it is submitted to the action of acids "of the ordinary strength used for bleaching purposes," for two hours in the same tubs, washed again, and returned to the kiers FF, where

"It must be boiled again in a solution of alkali of 2° No. 1 hydrometer (Twaddell's), which should be continued for about four hours, or until the strength of the alkali is spent, when *the pulp* and alkaline liquor are poured back into the tub C again, and washed, as above described."

The chlorine and bleaching liquor is then applied, and

"After the working of the whole of this improved bleaching machinery or apparatus, as above described, the straw pulp or other fibrous material will be perfectly bleached, and fit for the manufacture of white paper."

It is manifest that he used the boiling in alkaline solution, of a low strength, only for the purpose of aiding the bleaching operation, and not for the purpose of aiding in producing pulp, as that, in his view, had already been done. But the product thus obtained was not fit to be manufactured into white paper, nor was it perfectly bleached. It was not fit for the manufacture of paper, because the intercellular matter had only been softened by the lime, not removed by it.

The result was a very imperfect pulp, which could only be and which actually was, manufactured into inferior kinds of paper.

(*See Specification, pp.* 362–417; *Wright, p.* 236, *int.* 104; *p.* 228, *int.* 32.)

Nor was this pulp, such as it was, capable of being perfectly bleached. The cause which would prevent it from bleaching, existed not in Wright's process alone, but in all the attempts to make pulp from wood or straw that preceded the invention of Coupier & Mellier. It is the well known fact, now stated in every work on chemistry as applied to the arts, that the solutions of lime, or the "milk of lime," at the temperature of the boiling point, or higher, fixes the coloring matter in the material so firmly that neither chlorine nor alkali, separately or combined, can remove it. They may destroy the material; but the coloring matter adheres to the last.

This fact is first noticed in the introduction to the specification of the American patent of Coupier & Mellier (*Record, p.* 370).

"This process is simple, efficacious and economical, but the success depends entirely on the strength of the liquid employed and the purity of the hydrate of soda or potash for we have discovered that, usually, in attempts hitherto made to attain pulp from such materials, and to bleach the same, the failure has been in part owing to the presence of lime (a very common occurrence), in the solution of soda and potash. *Where lime is present,* the pulp will always retain a yellowish or dingy color.

"We are aware that alkalies have been used before for treating vegetable fibres, but in such cases the alkalies have either not been employed in their caustic state, or the lime which has been present has rendered every such attempt to make white paper from straw entirely unsuccessful."

This difference is brought out clearly and forcibly in the correspondence with the commissioner of patents previous to the granting of the Mellier patent. (*See Beaumont's Letter, pp.* 263, 264). The Examiner (*Dr.*

Gale,) again refused to grant a patent to Mellier (*Record*, *p.* 264), and an appeal was taken to the commissioner (*Judge Mason*). By him it was referred to Examiner-in-Chief Baldwin, who reported in favor of granting the patent, and recognized the differences between Mellier & Wright (*pp.* 266–7). One of these differences is found in the fact that "the alkaline solution of Mellier is altogether free from lime, which is alleged to tend to fix the color, and makes the production of white paper from straw almost impossible, with a proper regard to the strength of the paper stock" (*p.* 267).

The commissioner approved of the report of the examiner for the reasons given by him, and allowed the patent (*p.* 267).

The presence of lime is found in all the preceding processes cited in the record, which seem to approach the inventions of Mellier and of Watt & Burgess.

Montgolfier says:

Second.—"When in the state of chips, it has been immersed for five or six days in *quick-lime*" (*p.*456, "*Second*)."

Gros describes part of his process as follows:

"Thus crushed, broken, cleansed and cut, the material must be submitted either immediately as it comes from the floor, or later at any time desired after it has been dried to preserve it, to *a lye of lime*, with or without the addition of salt of soda or any of the alkaline salts, according to the quality of the pulp that is to be made. This treatment with lye should continue from four to twelve hours" (*p.* 442).

Prof. Royers (*p.* 329, *int.* 10) interpolates a material element into his description of the preparation of the solution by Gross. There is no direction in the original which authorizes the use of the phrase "decanting the supernatant liquid."

Dubochet says:

"After boiling a quarter of an hour, there is added to one hundred

kilogrammes of material about sixty kilogrammes of caustic soda at twenty degrees, made as above described. When the material approaches a soft state, there are added two kilogrammes of *quick-lime*."

This is put into the same vessel in which is boiled the "vegetable material;" he does not mention wood particularly.

Roque says:

"The plants are then macerated in a bath of lime during eight or ten days."

Clothon Breuil, used a lye composed of salt of soda and lime (*p.* 480–4).

Legoux uses

"A caustic lye composed of two parts of kelp, soda or potash, the other of boracic acid, *and of quick-lime reduced to powder*" (*p.* 484, *2d operation*).

It may seem of slight consequence whether the causticised soda should be drawn off before it is used, into a separate vessel from that in which it has been made by the action of the lime, or whether it should be used in the presence of the residuum of lime or carbonate of lime, but in one case the paper will become white, in the other it will remain brown or yellow. Coupier & Mellier, and Watt & Burgess, were the first to discover this improvement, contemporaneously, in different countries. Mellier used the discovery which he had made conjointly with Coupier.

It is submitted, therefore, that it is conclusively proved that pure pulp, fit to be bleached and manufactured at once into white paper, cannot be obtained from wood or straw without the use of pure caustic soda, free from the presence of lime, of the strength of about 2° Beaumé, and at a temperature of about 310° for straw, and at a temperature exceeding 300°

Fahrenheit for wood, with a strength of pure caustic alkali running as high as 8° Beaumé for some kinds of wood, and 12° for other kinds, for three hours or more, according to the nature of the substance treated, and that Watt & Burgess and Mellier were the first to make this discovery.

The pure article of cellulose, in form and substance fit for the manufacture of paper, which they produced, was never seen before their discovery.

In the books to which we usually resort to ascertain the progress of inventions we find notices of the difficulties we have been considering, and of the obstacles in the way of introducing improvements into the manufacture of paper.

As late as 1855, Dr. Lyon Playfair, in his reply to the Minute Paper of the Board of Trade, says:

"Many attempts have been made to furnish the new raw materials for paper, but hitherto with only partial success. The failure generally results from one or more of three causes. Some fibres require so much cost to bring them to the state in which they are offered to paper makers, in the form of rags or cotton waste, that in point of economy they cannot enter into competition with the latter. Certain fibres lose so much weight in bringing them to this state, that they cease to be economical Certain fibres, which are well adapted on account of their texture for the paper trade, present so many difficulties in bleaching them as to render them unfit for white paper. The Surat bass, in which cotton has of late years been imported into the country, offers an example of this difficulty."—*Year Book of Facts*, 1855.

Wright testifies (*fol.* 166, *int.* 10) that he had delivered some of his specimens to Dr. Playfair previous to the French Exposition of that year.

The manufacture of straw paper, in its early history, did not receive a more favorable notice in this country. Mr. Wells, late the Special Commissioner of the Revenue, wrote, in 1856, as follows:

"Empirical experiment rarely leads to success in chemistry. The materials from which paper can be manufactured exist in abundance; but this avails nothing so long as the cost of converting them into paper exceeds a certain limit. The attempt to convert straw into white

paper is an example. That it can be effected is no question, but that it can be effected profitably is yet to be demonstrated. The process, as ordinarily pursued, is a simple one, and not covered by any patent. The heads, grain, and all knots and joints must be removed by chopping and winnowing; a process involving considerable expense and much loss in weight. The silica investing the straw, together with much gum and coloring matter, must be then removed by the action of a caustic alkali. The alkali effects the separation of these substances by uniting with them, and forming soluble silicate of soda, or potash and soluble soaps. It is claimed that a large part of the alkali so expended may be recovered by evaporating the residuary liquors and calcining the deposited matters. Theoretically, this can be done; practically, with economy, it cannot. In these operations, and in bleaching, the straw suffers a depreciation in weight of at least sixty per cent., and is then inferior to rag stock. From long and careful experience we are convinced that white paper cannot profitably be manufactured from straw, or analogous materials, by any of the processes now in use."—*Annual of Scientific Discovery for* 1855, *page* 100.

The patented processes used by the complainants were then hardly known in this country. They were even less known in England. For we find that even as late as 1866, in a book published in London, entitled "*Novelties, Inventions and Curiosities in Art and Manufactures*," the state of the art of manufacture of paper from straw is spoken of as follows:

"Hopes were entertained some years ago that good paper might be made from straw. One of the principal tanneries in Bermondsey, called Neckinger Mills, was originally a straw paper manufactory. It appears that the straw was cut up into pieces two or three inches in length, steeped in cold lime-water, and cut into infinitesimal fragments in a paper mill; the pulp thus produced was made into paper by the usual train of processes. But the enterprise failed in Bermondsey, and a second time failed at Thames Bank; the paper produced was harsh and ill-colored. A further attempt was made to brave the difficulties; additional processes were adopted to free the straw from knots, to extract the coloring matter, to dispose it to become fibrous, to free it from mucilage and silicious particles, and also from the odor of many of the chemicals employed in the former processes—all means were adopted, in short, to coax it to become a good paper-making material; but these numerous processes became at length very costly, and the straw paper was neither fine enough nor strong enough to command an adequate price. So it died a commercial death."

The first edition of this work was published in 1858,

and the above clause has been retained in subsequent editions without alteration.

The following summary of the art in 1862, is taken from the reports of the juries of the International Exhibition of 1862:

The effect of the impression made on the public mind by the alleged approaching scarcity of rags, is well shown by the extraordinary number and variety of substances, more or less fibrous, for which patents have been applied for since the beginning of 1852, although the reduction of the expense of patent by the passing of the Patent Amendment Act in that year, has, no doubt, largely contributed to the increase. It may not be without interest to record the names of some of these substances for which patents have actually been taken out since the year 1852, viz., spartum, or winter-broom, wood-shavings, hop-plant, hop-bine, Brazilian grass, Indian grass, refuse tan, refuse cocoa-nut fibre, roots of potatoes, parsnips, turnips, mangold-wurzel, clover, thistles, nettles, and dried grass, New Zealand flax, creeping plant called giagia, iris, or fleur-de-lis, stems of mustard, tobacco-leaf, stems or stalks, hollyhocks, hay, sea-tree mallow or lavatera, arborea marine, plantain, palms, spent dye-woods, rice, straw, seaweed, surat, jute, gunny-bagging, Jerusalem artichokes, cuttings of leather, horseradish, rock-grass, stalks of rhubarb, esparto and many others. Since the passing of the Patent Amendment Act in 1852, to the close of 1857, no fewer than 147 patents appear to have been obtained for improvements in paper, chiefly for the suggestions of new materials; but, with the exception of straw and esparto, and on a more limited scale, the hop-bine, we are not aware that any of the above patents have come into general or profitable use.

The possibility of making white paper from straw was first tested in England by Matthias Koops, who published a work in 1800, some sheets of which were printed on straw paper.

The idea lay dormant till about 1842, when Lemuel W. Wright patented (December 14, 1843) a process of making white paper from straw by the use of alkalies and high-pressure steam. £30,000 were spent at St. Mary's, near Stroud, Gloucestershire; but the plan was never carried out, and after a struggling existence as a brown paper mill, the works were broken up in 1850.

Messrs. Coupier and Mellier, the latter a French paper-maker, who had purchased Wright's French patent, exhibited in 1851, a few small sheets of white paper by an improved process, for which they obtained a patent. Its chief novelty was the use of highly concentrated *caustic* leys, boiling for eight or ten hours, and then bleaching in a strong chlorine bath.

The enormous expense for chemicals, and the wear and tear of machinery consequent upon their use, prevented any large development of the straw paper trade till about 1855, when three patentees, Sul-

livan, Mellier and Jullion, almost simultaneously invented improvements.

Those of Sullivan consisted in obtaining a fibre capable of being bleached although boiled in a *weak* solution of caustic lye, by the use of superheated steam continued for many hours, in a common kier.

Mellier abandoned the kier and substituted a revolving boiler *filled* as full as possible with a very weak caustic lye, and boiling under great pressure for a short time by means of tubes containing steam of at least ninety to one hundred pounds pressure.

Jullion used a rotary boiler, as best calculated to disintegrate the fibre when boiling, and a peculiar movement to *alternate* the effects of the steam and the chemicals on the fibre. The chemicals used were caustic alkaline leys, and for some substances sulphurets. The steam was directly admitted into the boiler.

The effect of such process was to separate the fibrous portion of the straw from the silica and cellular matters that enclose it, and which are carried away by the chemicals in solution. This leaves it in a fit state to be bleached in a chlorine bath, in which it lies for some hours.

All three processes continue successfully at work, some makers using one process, some another, as best suited to their several makers and localities.

It is a doubtful question whether straw paper will ever permanently rank among our large manufactures.

The progress of agricultural chemistry, rapidly awakening landlords and farmers to the impossibility of obtaining *good crops* from the soil, except it is replenished, not only with all the gases, but also the alkaline earths absorbed from it by every fibrous crop, and the number of farms on which the sale of straw is prohibited, is constantly increasing.

The majority of the present straw mills each consume from 1,000 to 3,000 tons of straw yearly, with the effect not only of causing a great scarcity for brick-making and other purposes, but also of permanently advancing the price within a large radius so as seriously to interfere with their commercial success.

Other patents have been obtained during the last ten years, some with ingenious, others with impracticable processes, but the three above mentioned are, as yet, the only ones carried out on any large scale.

It is not till 1864, that we find Mr. Wells editing the *Annual of Scientific Discovery* for 1863, writing as follows :

"*Straw.*—For many years the attempt has been made to render the fibre contained in straw *profitably* available for the production of white paper, but with indifferent success, until within the last year, when the problem has been solved without doubt. This realization of the

desired end is effected by boiling the straw in an alkaline lye, in a rotary boiler, under a steam pressure of from one hundred to one hundred and forty pounds per square inch. Under such a pressure and temperature, the silica and other constituents of the straw, which render its fibre brittle and difficult to bleach, entirely give way and separate to such an extent that they can be almost entirely removed by simple washing, leaving its fibre soft and in a condition to bleach most readily and economically. We regard this discovery as one of the most important made during the present century, and as certain to reduce ultimately the price of paper to a lower rate than has heretofore prevailed."

Similar Inventions.

There are many inventions which first made their appearance in the form of results long before science discovered the precise law by which they were produced. The history of the ceramic art discloses many such. Pottery, porcelain and glass, were discoveries purely accidental or empirical. The discovery of the art of making porcelain in Europe was purely empirical. The inventions of Palissy are romantically so. After years spent in endeavoring to work out his idea of the beautiful enamels with which he believed he could ornament the coarse potteries of his age; after he had exhausted all his means in constructing furnaces in which to try his experiments, and had given all his earnings for fuel to supply the heat; after he had lost the regard of his friends, and his own domestic happiness, by persisting so long in an unsuccessful pursuit, he resolved on one more and a last trial. As he tells us in his quaint and plaintive story, when he had put up three hundred or more parcels of such material as he supposed might, when melted, unite and form the ideal enamel, he charged his furnace with them, and when the fuel which he had thought sufficient was exhausted before the melting was completed, he fed the fires with his fences, his furniture and his floors. When the furnace was opened, one of these parcels had melted into the substance he had so long hoped and worked for. It still required years of experiments before he could

make the working of his discovery profitable, and to the last, and with the closest observation, he could never be sure that the product of his furnaces would be certain, as an unequal temperature or over-heating would make the contents worthless.

Morley's Life of Palissy, Chaps. XI, XIII.

The substance which he produced was an enamel composed of ingredients of which he did not know the chemical properties, compounded only by guess, and which had to be melted at one degree of heat, and baked at another, in one process in a close furnace, whose contents could not be observed or inspected, without any means of measuring the degree of heat, and with the result depending entirely upon the skill and judgment of the operator as to the length of time the process should continue. Yet here certainly was an invention, new in the ceramic art, resulting in a new manufacture, not merely a new composition of matter. Some hundreds of years later came the chemists, who analyzed these ingredients and ascertained their component parts and properties, and who have given directions to the minutest grain for the prepartion of the compounds for the furnace. But they were still at fault with regard to the temperature required for the operation. This was still left to the skill and judgment of the operator, which could only be obtained by long experience; but now, within a few years, another discoverer has invented a pyrometer, which will not only measure but register the degree at which the compound fuses, and that at which it begins to harden and glaze, so that the director of a porcelain factory can sit at his desk and know by watching the indicators the exact stage of the process in each furnace under his care, and give orders to increase or withdraw the fuel from each, and be informed when the process is completed and the baking perfect, with as much certainty as if the furnaces were open to his sight. Nothing is now lost by being either imperfectly done or overdone.

If the rule contended for by the defendants should be applied to this art, we should be told that there had been no patentable invention until the graduation of the heat and the true adjustment of the component parts had been measured and described in degrees and formulas known to modern science. But this surely cannot be so. The art is that which produces the new result, rude perhaps in its beginning, and capable of being improved by science. It may be difficult sometimes to tell where art ceases and science begins, but it is never difficult to ascertain whether the product of both is not something new and valuable, and which in the science of chemistry as applied to the arts, must be either a new composition of matter or a new manufacture, equally under the protection of the patent laws.

Another recent instance is very instructive. In Bessemer's process for converting pig-iron and some iron ores into steel at one operation, his original instructions were to draw the fires as soon as the surplus carbon had been burned out, and before the iron itself began to be consumed. The skill, experience and judgment of the operator were relied upon to tell when this stage had been reached. It was the only mode of doing so, and hence his patent was not vitiated by his not giving a better. But it is one of the wonders of the recently discovered spectroscope that it can distinguish the flames of burning metals, and when applied to the Bessemer process, it developes the peculiar color of the flame of burning iron as soon as combustion attacks it, and marks the precise instant when the action of the furnaces should cease.

These instances might be multiplied indefinitely.

Professor Rand says (*p.* 217, *int.* 78), "No mere direction, verbal or written, will enable a man successfully to carry out chemical manufacturing operations without some experience."

See *Mowry* vs. *Whitney*, 14 *Wallace*, 620, *pp.* 644–5).

No Rival Claimant to the Invention.

These defendants do not claim to be inventors of the process by the use of heat and alkali, or of the product, and do not claim the right to use these inventions under any rival patent. They entered upon this infringement deliberately in the fall of 1864, long after the taking out of the reissued patents of 1863. Their only defense is that this invention is public property, and that it has become so in one of two ways; either from the fact of its having been invented and given to the public in some printed publication prior to the date of the original patent, or that the patents afford it no protection. This last ground has been examined thoroughly, and the patents shown to conform to the invention, and to have been taken out strictly within the requirements of the law. The proof of the first ground has failed utterly. Not a word of sworn testimony supports it. It is sustained only by an argument which rests upon nothing but suggestion and inference. If this invention, which has developed itself into an industry felt by the whole nation, which is seen in daily use in paper-mills producing upwards of twenty tons of paper per day, had been known and used before, some relic of it would surely have been found somewhere upon the earth. Paper, it is true, is one of the most destructible of substances, yet, on the other hand, there is no manufactured article which is more carefully preserved. The libraries of the world and the archives of governments probably show samples of the better kinds of paper that have been made in every considerable paper-mill that has ever been set up. The whole world has been ransacked for some exhibit to destroy these patents, but nothing has been found. No prior benefactor of the race can deprive these persons of the glory of their great invention. Where is the paper mill, and who is the owner, that has drawn the raw material for his manufacture from the forest?

Who, before these inventors, ever assailed the pine-clad mountain and the reedy marsh, and made them tributary to the intellectual wants of mankind? It is entirely clear that at some time between 1851 and 1854 this invention was made and that it has grown into a great and successful use. Shall those who have developed it be robbed of the profits of it by unprincipled infringers, who defend their piracy only by hypercriticism of the language in which the protective patent is expressed?

It would be a disgrace to the patent laws of this country if such a wrong could be permitted. I ask for these patentees the application of the same rules of construction and the same principles of law that saved the patents of Charles Goodyear in the suit of *Goodyear* vs. *Day*, in New Jersey, 2 *Wallace, C. C. R.*, 299.

MR. JUSTICE GRIER:

"The fourth objection is that 'the latter patent claims more than was described in the original.' If the latter patent is for precisely the same invention, art or discovery as that described in the first, the objection that it claims more is a mistake of fact. If the last patent differs from the first only in stating more clearly and definitely the real principles of invention, so that those who wish to pirate it may not be allowed to pirate it with impunity through the imperfection of the language used in the first, then has arisen one of the cases for which it was the intention of the Act of Congress to provide, and the objection is worthless in point of law."

And again, GRIER, J.:

"It was usually the case, when any valuable discovery was made, or any new machine of great utility has been invented, that the attention of the public has been turned to that subject previously, and that many have been making researches and experiments. Philosophers and mechanicians may have in some measure anticipated in their speculations the possibility or probability of such discovery or invention; many experiments may have been unsuccessfully tried, coming very near, yet falling very short of the desired result. They have produced nothing beneficial. The invention, when perfected, may truly be said to be the culminating point of many experiments, not only by the inventor, but by many others. He may be profited indirectly by the unsuccessful experiments of others, but it gives them no right to claim a share of the

honor or profit of the successful inventor. It is when speculation has been reduced to practice, when experiment has resulted in discovery, and when that discovery has been perfected by patient and continued experiments, when some new compound, art, manufacture or machine has been thus produced, which is useful to the public, that the party making it becomes a public benefactor, and entitled to a patent.

"And yet when genius and patient perseverance have at length succeeded, in spite of sneers and scoffs, in perfecting some valuable invention or discovery, how seldom is it followed by reward! Envy robs him of the honor, while speculators, swindlers and pirates rob him of the profits. Every unsuccessful experimentor who did or did not come very near making a discovery now claims it. Every one who can invent an improvement, or vary its form, claims a right to pirate the original discovery. We need not summon Morse or Blanchard or Woodworth to prove that this is the usual history of every great discovery or invention.

"The present case adds another chapter to this long and uniform history."

The Keen Patents.

These are for the boilers in which the wood is boiled in alkali under pressure. The first, dated September 13th, 1859 (*pp.* 40, 41), claims a boiler of the peculiar construction described, "with an expansion-chamber, stirrers, and discharge-valve, or cock, arranged for the purposes" described. These "purposes" are, *first*, for the boiling of the mass in the most thorough manner, keeping it stirred or in motion, so that all parts shall be acted upon by the heat equally; and *second*, for the discharge of the disintegrated mass, under pressure through the discharge-valve, into the tank where it is to be washed.

The second patent, dated June 16, 1863 (*pp.* 43–44), is also for a boiler, to be used for the same general purpose as the first, but without the stirrers, and with an original arrangement of devices for charging, and also for blowing off, the contents.

The infringement of these patents is proved by *McCracken* (*p.* 72, *int.* 10); *Burgess* (*p.* 82, *int.* 7, *p.* 84, *ints.* 18, 19); *Rand* (*pp.* 91, 92, *ints.* 9-11), and by *Townsend*, defendant's witness (*p.* 198, *ints.* 16, *p.* 157,

ints. 123-128). This witness says the "feed-hole" was below the diaphragm, not through it (*p.* 148, *int.* 18, *p.* 157, *ints.* 120-122). But the discharge-cock was in the same place and performed the same duty as in Keen's (*p.* 157, *ints.* 126-128), *McCracken* (*p.* 73, *int.* 15).

Upon this evidence, the finding of the court below (Judge Benedict), is as follows (6 *Blatchford Rep.*, *p.* 33):

"There remains to be considered the two boiler patents which are set out in the bill. As to those, it seems sufficient to say that the first boiler patent of Keen, No. 25,418, is for a combination, of which the stirrers described are a material part. The evidence shows, however, that the stirrers are not used by the defendants. Not using the plaintiffs' combination, they do not infringe their patent."

But the proof is clear that they had infringed the patent for a long period prior to the commencement of the suit by using the stirrers, as well as the rest of the combination. The proof of a single act of infringement, prior to the commencement of the suit, entitles the complainants to a decree. *McCracken* (*p.* 73, *int.* 21) says that the agitator was not taken out of the boiler while he was there; and *Townsend* (*p.* 148, *int.* 16) says that a stirrer was used in both boilers, and that one was taken out "from eight to ten months previous to the works being closed," and that they "did not use the stirrer in the other boiler for about four months before the closing of the works. The works were closed the 1st of August, 1866." The bill was filed March 17th, 1866 (*p.* 1). This shows that one of the stirrers was in use at the date of the commencement of the suit.

The finding of the court below with regard to the infringement of this patent is therefore erroneous in law and in fact.

The judge proceeds (6 *Blatchford*, 33):

"The second boiler patent of 1863, No. 38,901, is for a combination, of which the diaphragm and well are material parts. The defendants

use no well with the diaphragam, but charge their boiler below the diaphragm. There is, then, no use of the plaintiff's combination secured by the patent. So far, then, as the plaintiffs' case rests upon these two boiler patents, it must fail."

But this patent has two arrangements of devices in connection with the boiler, for two very different purposes; one purpose is to charge the boiler so that there shall be no refuse or waste, and this is accomplished by making a "feed-hole" or "well" into the boiler through the diaphragm, so that the chips or other stock shall fall directly into the boiler when the cover is removed. Precisely the same purpose is accomplished in the defendants' boilers by making a "feed-hole" or "well" just below the diaphragm, and pushing the stock through it into the boiler. Here are the three elements of the combination—the boiler, the perforated diaphragm and the feed-hole—arranged so as to accomplish precisely the same purpose as in Keen's boiler, although not in so simple a manner. Each element is not only the "substantial equivalent" of the corresponding device in the other (*Keen's claim, p.* 44), but is precisely the same, although the place, not the function, of one of the elements is changed. Construing the patent with the object of the invention in view (*Mowry* vs. *Whitney*, 14 *Wallace*, 645), the combination of devices in the defendants' apparatus, is precisely the same as that covered by the first claim of the Keen patent of 1863.

But there is another combination of devices in Keen's apparatus for a different purpose, and which is the subject of the second claim of the patent. That purpose is for the discharge of the contents of the boiler, when the intercellular matter of the wood has been removed. The mode of charging the boiler, and the devices by which the charging has been accomplished, have nothing to do with this second object.

The boiler may have been filled in any manner, so that it be filled, and its contents ready to be discharged.

The "well" is certainly no part of this combination. It is not questioned that the devices for discharging the boilers in the defendants' apparatus, are identical with those which are the subject of the second clause of this patent, and operate in combination in the same way and for the same object.

The hypothesis upon which the defendants' experts find the same combinations in *Wise's* specification (*H. B. Renwick, p.* 184, *int.* 7; *E. S. Renwick, pp.* 193, 4, *int.* 7), are too fine-spun to deserve consideration. *Wise's* apparatus, in design, construction, operation and purpose, was wholly different from Keen's. Equally illusory is the attempt to anticipate the mode of discharge from the Keen boilers (*H. B. Renwick, pp.* 184–5, *int.* 8; *E. S. Renwick, pp.* 194–5, *int.* 8), by the mode of lifting the contents of one boiler or tank to another in Wright's patent. They resemble each other in only one thing, and that is, that steam is the motive power in each.

The Mellier Patent.

Although notice was given in the answer that reference would be made to Wright's patents, and to the extracts from the *Central Blatte*, to prove the want of novelty in the invention patented by Mellier, yet the experts called by the defendants have taken no such ground, and the validity of the Mellier patent stands unimpeached.

The only questions to be determined upon this patent, therefore, are those of construction and infringement. The specification will be found in the record (*pp.* 18–20). It is for a process, "a new and useful improvement in making paper pulp."

The character of the invention is stated on pages 18 and 19; and the result of its use on page 19, as follows:

"The straw or other fibrous materials requiring a like process to prepare the same for the paper manufacture, is first, as heretofore, to be cut in a chaff-cutting or other machine into short lengths, and to be freed from knots, dirt, or dust, and then steeped for a few hours in hot

water. The straw or fibrous materials, and a weak solution of caustic alkali, are then to be placed in a suitable close boiler, heated by steam, as hereinafter explained, and the heat is to be raised to such a degree as to attain and maintain for a time a pressure internally of the boiler equal to or exceeding seventy pounds on the square inch—that is, about 310 degrees of Fahrenheit—by which means a considerable saving of alkali, as well as time and fuel, results, as compared with the means of using a hot solution of caustic alkali, as now practiced in preparing straw and other fibres for paper-makers.

"By means of submitting the straw or similar fibrous materials to the pressure of between 70 and 80 pounds on the square inch inside of the boiler, I can reduce considerably the proportion of alkali, and the solution which I prefer to use is to be from two to three degrees of Beaumé, or of a specific gravity of from 1,013 to 1,020, and at the rate of about 70 gallons of such solution to each cwt. of straw or other fibrous vegetable matter requiring like treatment."

The claims of this patent are as follows (*p.* 20):

"Having thus described the nature of my said invention, and the manner of performing the same, I would have it understood that I do not claim the general use of caustic alkaline solution, nor the employment generally of a close boiler for boiling straw, or other vegetable fibrous substances."

"But what I claim as my invention, and desire to secure by letters patent, is the use of a solution of caustic soda (NaO), in a compartment of a rotary vessel, separate from that which contains the steam heat, substantially as described."

"I also claim the within described process for bleaching straw, consisting in boiling it in a solution of pure caustic soda (NaO), from 2 to 3 degrees Beaumé, at a temperature of not less than 310 degrees Fahrenheit, *after* it has been soaked and cleansed, and before submitting it to the action of a solution of chloride of lime, from 1 to 1½ degrees, substantially as described."

The elements stated in this claim whose combined action reduce the straw to a condition fit to be made into paper, are the following:

First.—The straw, soaked and cleaned, before being submitted to any chemical action.

Second.—A solution of pure caustic soda (NaO), at a strength of from 2 to 3 degrees Beaumé.

Third.—A temperature of not less than 310 degrees Fahrenheit, which necessarily implies boiling in a close vessel.

The elements are to be prepared and the operation is to be performed substantially as described.

Straw as well as bamboo was pulped at the works of the defendants (*Howland, p.* 175, *ints.* 2–5 ; *Townsend, p.* 47, *int.* 3, *p.* 149 *ints.* 23–30).

Some confusion has arisen, in the construction of this specification, from the fact that it speaks of a pressure of seventy pounds being equivalent to a temperature of 310 degrees. But the claim is confined to the *temperature*, and the pressure is spoken of only as a means of measuring it. The temperature of the contents of a boiler during its action cannot be readily measured by a thermometer, and it is generally ascertained by comparing the tables of steam pressure with the tables of temperature.

The oldest and best known of these are called "the French tables." By these a pressure of seventy pounds corresponds very nearly to the temperature of 310° F. Mellier says (*specification, p.* 19) : "The heat is to be raised" (after the materials are placed in the boiler) "to such a degree as to attain and maintain for a time a pressure internally of the boiler equal to or exceeding seventy pounds on the square inch, that is about 310° of Fahrenheit," &c.

In another part of the specification he says (*p.* 20) :

"A steam gauge properly fixed upon the boiler will enable one to ascertain when the pressure has attained the required degree."

The claim is for the use of the high temperature, and is not qualified or made obscure by the mode of measuring that temperature.

It appears from the testimony of Dr. Rand (*pp.* 90–91, *int.* 8; *pp.* 103, 104, *ints.* 46, 48 ; *p.* 204, *int.* 4 ; *p.* 119), that the French tables start from a vacuum as zero, and give the entire internal pressure corresponding to the temperatures, whereas our steam-gauges only indicate the difference between the pressure of

the atmosphere and the entire internal pressure. This statement is not contradicted or varied, and is the actual fact. Drs. Rand and Cresson have, by a series of carefully conducted experiments, ascertained the corresponding temperatures and pressures when caustic alkali is used, and they are to be found calculated on *p.* 225 of the record. To ascertain the entire internal pressure upon the contents of the defendants' boilers, the weight of the atmosphere, averaging 14 $\frac{7}{10}$ pounds, must be added to the pressure indicated by the steam-gauges.

The mode of measuring the degree of temperature by pressure or otherwise was no part of Mellier's invention. It was a matter to be learned from the books. Mellier wrote for those skilled in the use of high pressures and steam-gauges, and he took for granted that every one who would use his invention would know, as he ought to know, that all ordinary steam-gauges worked against the pressure of the atmosphere. Hence he is very precise in stating that the pressure which he referred to was the *pressure within the boiler*, not the difference between the internal pressure of the steam and the external pressure of the air. Thus he says (*p.* 19), in the passage above quoted, "the heat is to be raised to such a degree as to attain and maintain for a time *a pressure internally of the boiler* equal to and exceeding seventy pounds on the square inch;" and again (*p.* 20), "by means of submitting the straw or similar fibrous materials to a pressure between 70 *to* 84 *pounds on the square inch inside the boiler*," &c. He says, also, "a steam-gauge properly fixed upon the boiler will enable one to ascertain when the pressure has attained the required degree." How? Not by anything upon the gauge itself, because that only indicates pounds. The pounds are to be turned into degrees, and that can only be done by reference to the tables then in use. The specification gives but one of the corresponding readings from those tables, 70 lbs. = 310° F., and in precise, unambiguous language, refers to the internal pressure.

This construction has been affirmed by judicial decision.

In the case of the present complainants *vs.* Hefft *et al.*, in the eastern district of Pennsylvania, Judge Cadwallader said :

"In the meantime, we may remark, that wherever the number of pounds of pressure is mentioned by Melleir, he means the internal pressure, exceeding by 14 7-10 pounds the pressure as indicated on the steam-gauges here in use, the difference being the weight of the atmosphere. This difference must always be considered in comparing this French expression of the measure with the usual expression of it in this country. Thus the measure of 70 lbs. in the specification of Mellier corresponds with about 55lbs. on the steam-gauge here in use. His French patent mentions a pressure of five or six atmospheres. From the less extreme, five atmospheres, the deduction of one for this difference leaves the minimum four atmospheres, not quite 59 lbs. An observation of less importance is that the tables used by him, according to which the degrees of heat are tested by the pressures, must have been somewhat inaccurate."

In the court below Judge Benedict disposed of the question of pressure as follows :

"But the respondents insist that they do not infringe the Mellier patent, because they use a pressure lower than the minimum pressure required by the Mellier process, which they claim to be the pressure represented by 70 lbs upon the steam-gauge. Upon this point I concur with Judge Cadwallader, in the opinion that the minimum pressure of the Mellier patent is the pressure indicated by 55 lbs. upon the steam-gauge instead of 70 lbs. It is true that the patent designated 70 lbs., but it says internal pressure, and gives 310° F. as the corresponding temperature. Now, 310° F. is not a temperature corresponding with 70 lbs., as indicated by the steam-gange ; and it is quite evident, I think, that the patentee, in mentioning 70 lbs., had in his mind the French tables, which differ from the American tables, and according to which, the weight of one atmosphere, 14 7-10, must be deducted to give the gauge-pressure intended to be indicated. Nor does the statement in the specification, that a "steam-guage properly fixed will enable one to ascertain when the pressure had attained the required degree," appear to me to be inconsistent with this construction. Any skillful person must see from the specification, that the internal pressure was to be considered, and that pressure he would ascertain by adding an atmosphere to the reading of the gauge."

See also opinion of Judge Hall of the Northern Dis-

trict of New York (*Record, pp.* 22–33, *and particularly pp.* 27–28 *as, follows*) :

" The real discovery of Mellier, the main idea—the spirit or principle of his invention—was, that the known effects of a solution of pure caustic soda, which had been previously advantageously used for boiling straw and other fibrous materials of similar character and texture in open vessels, in which the heat could be raised only to 212 degrees Fahrenheit, might, by the use of a much higher degree of heat, not less than 310 degrees Fahrenheit, be advantageously and greatly increased, while the lessening of the time the fibre was subjected to the action of the caustic alkaline solution, and the use of the weaker solution, which could thus be advantageously used, would be less injurious to the fibre, as well as more economical in its use and application. This was the discovery or principle to be developed and practically applied, and he embodied that principle, and arranged and described the means of its practical application, for the purposes specified in the mode and manner particularly described in his specification. This mode, he says, he *prefers*, and he *recommends* a particular construction of the boiler as proper to be used in the practical application of the leading idea and principle of his invention. But, aware that inferior forms may be devised by any mechanic, and that superior forms and modes of construction and application may be devised after the use of his process has become familiar, he very wisely makes his second claim broad enough to cover his actual discovery and invention, irrespective of the particular form or construction of the vessel in which the boiling process might be carried on." * * * * * *

" It was strongly urged by the defendant's counsel that the language of the second claim excludes the idea of every temperature exceeding 310 degrees Fahrenheit;" and it was said, " The term 'of not less than 310 degrees Fahrenheit,' has no reference to higher degrees. It names a specific temperature, and provides against less, without including more. The phrase '*not less than*' fixes a *minimum* limit, without regard to a maximum."

" If this position is well taken, and can be maintained in all its strictness, then most surely the patentee is limited to the precise heat of 310 degrees, and any one may use what is substantially his process with impunity, provided the heat employed is a few degrees above or below the standard thus set up. *But we think this position cannot be maintained.* It is entirely clear that such was not the intention of the patentee or of the person who drew this specification, for neither could have intended so to limit the claim of the patent as to render it of no practical value. The discovery made was that the higher degrees of heat and pressure could produce the desired result; and while the minimum heat requisite to produce a really beneficial result was stated, no upward limit was fixed so long as the process carried on by that degree of heat was in fact a *boiling* process, under the conditions, in substance, as stated in the specification."

The scope of the invention, as described in the specifications, is thus stated by Judge Benedict:

"In the Pennsylvania case the point was fairly raised, and upon it Judge Cadwallader expressed the opinion that the patent would cover any fibrous vegetable substance requiring like treatment with straw for the purpose in view, and that wood was within its scope, while Mr. Justice Grier considered the patent to be confined to straw *et similia*. It appears to me quite manifest from the language of the specification, that the patentee considered his process as applicable and beneficial in the treatment, not only of straw, but also of other vegetable substances. He uses throughout, the phrase, 'straw and other vegetable fibrous materials, requiring like treatment.' His description of his process nowhere limits it to the single article of straw, and his patent is for his process as described; but he does, in the last clause of his specification, say: 'I also claim the within described process for bleaching straw, consisting, &c. * * * substantially as described.' Now, his process described is not a process for bleaching, in the ordinary acceptation of that term, nor is it a process for treating straw alone. No person looking at the whole paper would fail to see that the patented discovery related to other material as well as straw; and in view of the peculiar phraseology of the last clause, which is called the claim, and of the intention manifested elsewhere in the instrument, I incline to the opinion that, according to the principles applicable in the construction of patents, the last clause should not be held to be such a formal summing up and defining of the limits of the invention as to restrict the patents to the single substance there mentioned; and this must have been the conclusion of Mr. Justice Grier as well as of Judge Cadwallader. If, then, the patent extends to any other substance than straw, in the common and limited signification of the word, the respondents are within its scope by reason of their treatment of bamboo."

The construction given to the Mellier patent by Judge Hall, has been affirmed by Woodruff, Circuit Judge (8 *Blatchford Rep.*, 513, *p.* 516); *The American Wood Paper Company v. The Glens Falls Paper Company.*

"As to the merits of the case made by the complainant, it is sufficient for the decision of this case to say, that I concur in the opinion of Judge Hall (*Buchanan* v. *Howland*, 2 *Fisher; Patent Cases*, 341, 359), wherein he says: 'We think the patent of Mellier is valid; that he is the original and first inventor of the process claimed therein; that his invention is useful.' And I concur in the reasons for this conclusion fully stated in his opinion."

Conclusion.

The decree, so far as it relates to the Watt & Burgess patents and the Keen patents, should be reversed, and so far as it relates to the Mellier patent, should be affirmed. It is to be observed that the Court below undertook to determine the question of profits without a reference to a master. This is irregular.

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